

AFIT/GMO/LAL/97Y-9

**PRODUCTION TEAM MAINTENANCE:
SYSTEMIC CONSTRAINTS IMPACTING IMPLEMENTATION**

GRADUATE RESEARCH PROJECT

Terry F. Moore, Major, USAF

AFIT/GMO/LAL/97Y-9

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SYSTEMIC CONSTRAINTS IMPACTING IMPLEMENTATION**

Graduate Research Project

**Presented to the Faculty of the Graduate School of Logistics
and Acquisition Management of the Air Force Institute of Technology**

Air University

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Degree of Masters of Air Mobility**

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"The views expressed in this graduate research project are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government."

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Terry F. Moore

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Abstract

Almost four years after two comprehensive maintenance assessments were conducted in 1993, one in direct response to the catastrophic C-141 ground mishap at Travis Air Force Base, PTM has not matured in AMC as projected. The purpose of this research project was two-fold: a) to identify the factors adversely impacting implementation of Production Team Maintenance (PTM) in the KC-135 tanker maintenance community, and b) to propose recommendations to improve PTM's viability in the field. In addition to a comprehensive historical literature review of the conceptual evolution of PTM, two assessment methods, strategic control and the Theory of Constraints, were applied to analyze PTM at both strategic and operational levels. Five implicit assumptions integral to AMC's notional PTM model were introduced.

The research revealed several long-term strategic, physical, and procedural constraints that continue to inhibit full implementation of PTM nearly a decade after its inception. Identified constraints included: integrating the PTM positioning strategy into the AMC corporate strategic planning process, manpower modeling simulator limitations, labor force authorizations and decentralization, aircraft assignment/alignment, instructional guidance, the Integrated Tanker Unit Deployment operations concept, the 120-day personnel deployment policy, and the command training objective.

While the maintenance community rigorously held onto the original MAC guiding principles for nearly a decade, many events transpired that were not compatible with PTM. Over time, the accumulation of these new policies, which were developed to cope

with a very different post-Cold War national security environment, left the maintenance community wrongly postured for today's defense demands.

Several specific recommendations were proposed, all of which can be generalized into three categories. First, deliberately integrate PTM into the strategic-level operations management planning framework. Second, redefine PTM to better posture maintenance to support higher headquarters' strategic goals, objectives and operational tasks as well as Air Force and command policies. And third, restructure PTM to promote standardization within the KC-135 community and to improve its "fit" in the field.

PRODUCTION TEAM MAINTENANCE: SYSTEMIC CONSTRAINTS IMPACTING IMPLEMENTATION

I. Introduction

Background

Production Team Maintenance (PTM) is Air Mobility Command's (AMC) endorsed aircraft maintenance production policy. Its origin dates back to 1989 when the Military Airlift Command (MAC) conducted the MAC "New Look" and the "Doing More Enroute" initiatives. PTM was conceived with several prime goals: organize in peace as in war, place more stripes and experience on the production site, and decentralize control with decisions best made on the flight line. After testing the concept at Pope and McChord Air Force Bases, MAC units were directed to implement PTM under these guiding principles (Sherouse, 1996):

- Disband specialist dispatch functions and move specialists to the flight line.
- Convert crew chief authorizations to specialist authorizations to enhance availability.
- Integrate sortie-producing specialties into cohesive units called production teams.
- PTM members, regardless of specialty, would report to a PTM chief, the expeditor. The team would be a complement of mixed Air Force Specialty Codes (AFSCs) supporting six to eight aircraft.
- Flight line maintenance personnel would complete cross-

utilization training (CUT); crew chief to specialist and vice versa.

- Job control became a coordination center.

To date, a whirlwind of substantial organizational restructuring has jostled the maintenance community with multiple functional realignments and redefinition of key processes. These corporate Air Force and command initiatives (objective wing, RIVET WORKFORCE, two-level maintenance, Total Quality Management, base closures and realignments, and PTM) were "...designed to extract from the maintenance community the most productive capacity possible from the least possible investment required to perform the aircraft maintenance mission. The requirement will continue and accelerate" (Fromm, 1993), precluding any proposal to return to centralized maintenance concepts with detailed specialty structures.

In a 17 March 1993 white paper titled *Maintenance Training*, the AMC Chief of Maintenance Management and Training Division, Colonel James G. Fromm, consolidated feedback from the field regarding "concern with the way we are developing (training) our maintenance work force in this era of fundamental change and diminishing resources. It was concluded that work force training (not training, inadequately training, training the wrong thing, or not correctly utilizing trained personnel) was the unifying prescription for managing rapid change in the maintenance community" (Fromm, 1993). Logic followed that the maintenance community was wrongly postured for the prevailing demands. The complex structure established over the years to perform specific, well defined, and consistent processes had been shattered. The field was left with "no communal

agreement on what processes we're suppose to perform, who is supposed to perform them, and how (procedurally) we are to perform them" (Fromm, 1993).

It was this milieu that prompted command leadership to intentionally leave the PTM structure fluid, "vesting authority in logistics and operations group commanders to define, based on local conditions and available resources, their conversion schedules, optimal structure, AFSC mix, and training regimen." The critical caveat was that PTM was an "evolutionary entity at its heart, with a recognized path to full implementation...the decision (intentionally left) to local managers to form teams at locally appropriate levels (from the aircraft to flight to shift)...recognizing that wings will differ in their progress from a centralized structure to a decentralized aircraft-level PTM team (the ultimate goal)" (Fromm, 1993).

On the heels of AMC's in-depth look at the maintenance work force, there was the Fall 1993 wake-up call--the fiery inferno loss of an Air Force C-141 aircraft on the Travis Air Force Base. Fortunately, lives were not lost. The findings of the accident board investigation were many but left no doubt that a prime causal factor, if not the prime contributor, in the mishap was complacency (HQ 15 AF/SIB, 1993). An unacceptable attitude about the way maintainers conducted their production business day-to-day had permitted the loss of a critical national defense resource and unnecessarily put many lives at risk. Several interviewees, enlisted and officers, reiterated how dramatically the Air Force had changed in an eighteen-month period with business conducted in very new and different ways (HQ 15 AF/SIB, 1993).

The command-level aircraft maintenance functional managers initiated a "how-goes-it" review of flight line maintenance in the Air Mobility Command (AMC). They compiled their assessment results in a second paper, *AMC Maintenance Organization and Maintenance Quality*, and categorized the results as "alarming." These outcomes were substantiated by a follow-on Air Force Inspector General inquiry. The AMC white paper was considered along with the evolution of numerous, and all-encompassing, organizational force restructuring directives in progress at the turn of the post-Cold War decade. The findings were similar to the aforementioned March 1993 analysis. According to the Fall 1993 AMC Logistics Commander's "how-goes-it" flight line maintenance assessment, the PTM organization was poorly defined and the required mix of specialists and crew chiefs was not supported in the UMDs (Moffitt, 1994).

During the greatest period of change, we realigned major commands and simultaneously dispensed with lengthy, regulatory guidance in favor of short, less restrictive "instructions". In many ways the baby was thrown out with the bath water as old programs disappeared. We essentially asked our field commanders and their maintenance personnel to build their own organizations and policy. This appears to have ushered in a period of time under which we operated under "county options". As should be expected, the results were non-standard wing organizations, and significant variances wing to wing. (Moffitt, 1994)

Today, the current working definition of PTM is in AMCI 21-101, Maintenance Management Policy, dated 15 June 1995.

PTM integrates multiple AFSCs into teams that generate, launch, and recover aircraft. This pushes authority and responsibility for production decisions to the flight line where the aircraft generation resources are available. PTM is AMC's maintenance concept, and is designed to place people required for sortie generation on the flight line. All units will use the PTM concept. PTM integrates aircraft maintenance AFSCs into teams that generate aircraft. In AMC, these teams will be identified down to the SGF level and consist of mixed

APG/specialist personnel...(HQ AMC/LGP, 1995:30-31).

Standardization was the backbone of the model as well as the supporting organizational structure directing functional alignment to the element level. How operations would be managed was also specified by the accompanying PTM management philosophy which mirrored the MAC guiding principles. Flight line production teams would be a mix of specialties supporting six to eight aircraft per element.

Problem Statement

Nearly four years have passed since the 1993 maintenance assessments and standardized aircraft-level PTM team development has not matured as projected (Fromm, 1993). Implementation of AMC's PTM concept continues to be controversial. Some units claim they cannot survive without PTM while others state they cannot implement PTM with current manning levels (Sherouse, 1996). While the debate continues, PTM is not being uniformly implemented within or across all tanker flight line maintenance organizations.

Research Questions

The primary research question is, "What factors are adversely impacting implementation of PTM and how can its viability be improved within the KC-135 tanker community?" This question will be explored more in-depth by addressing several other subordinate issues. What are the disconnects between PTM and Air Force and command corporate strategies and competitive priorities? What are the constraints inhibiting full implementation of PTM? How well does the concept "fit" in the field today? Although

this research initiative will focus on the application of PTM to KC-135 tanker maintenance operations, dialog with strategic airlift maintainers indicate some common PTM challenges. Another timely consideration is the appropriateness of universal application of this production model to the C-130 maintenance community as it is integrated into the command this year.

Research Analysis Framework

A macro-level analysis of PTM is conducted within an operations management planning framework. Two assessment methods, strategic control and the Theory of Constraints, are applied to evaluate the progress of PTM implementation to date. As a service industry, flight line production operations are shaped by customer demands and the core competencies and competitive priorities corporate leadership determines to be relevant to their long-term customer service goals. In general, operations management encompasses the organization, direction, and control of maintenance production processes and resources (people, equipment, and money) used to transform customer mobility requests (inputs) into planned deployments and employments (outputs) as a finished service (product). The manufacturing-like maintenance production activities (scheduled and unscheduled remove, replace, and repair activities) are not the focus of this research project. Instead, the focus will be more broad-based, assessing the PTM model for linkage throughout corporate Air Force strategy, from headquarters to the operational (functional) level. The identification of systemic constraints (bottlenecks) affecting implementation of the construct are also examined. Analysis of the constraints

provide the opportunity to evaluate the AMC PTM model at a later stage in its evolution and its “fit” in the field as well as the chance to suggest future initiatives.

Research Paper Format

This research paper is comprised of four chapters including this introduction. Chapter two presents a comprehensive historical overview of PTM and its conceptual evolution. PTM’s place in the strategic planning environment is reviewed. In addition, the effect of various Air Force policies and command operational concepts on the viability of PTM is examined. In general, the groundwork is laid for identifying and analyzing the factors adversely impacting the full implementation of PTM.

An analysis of the PTM construct follows in chapter three with emphasis on underlying conceptual assumptions, findings, and identification of constraints that may lend insight to factors inhibiting PTM implementation. Chapter four highlights alternatives and options that may improve implementation efforts and the overall viability of the maintenance production concept in the KC-135 community.

II. Literature Review

Introduction

This literature review presents a historical overview of PTM and its conceptual evolution within an operations management planning framework and a dynamic national security environment. It is within this framework that the factors adversely impacting full implementation of PTM are identified. Disconnects between the PTM positioning strategy and higher headquarters' defense strategies, management tools, and operational and personnel policies are examined. Pertinent tools and policies include the Logistics Composite Model (LCOM) manpower simulator, the Integrated Tanker Unit Deployment (ITUD), the 120-day personnel deployment standard, and the HQ AMC/LGQ maintenance training objective.

Operations Management Planning Framework

The operations management planning framework provides a structure for organizations to purposefully develop linked corporate- and functional-level strategies. This strategic development process, in both the market system and the defense industry, is significantly impacted by public policy decisions. It is the public who "signs the checks" determining the shape, size, and posture of our future military force. PTM, a product of this process, is introduced as AMC's positioning strategy within the operations management planning framework.

Planning Framework. In the market system, a corporation performs a market analysis to identify the firm's customers, their needs, and an assessment of their competitor's strengths (Krajewski and Ritzman, 1996:28). This is accomplished in conjunction with an analysis of public policy issues (what public social agendas are prevalent) to determine how company resources will be allocated to maximize profits (Buchholz, 1990:27). From this information, a corporate strategy is developed identifying organizational goals and competitive priorities (Krajewski and Ritzman, 1996:28-29).

Businesses the firm will pursue, new opportunities and threats in the environment, growth objectives the company should achieve, and how it can differentiate itself from its competition are integral components of the long-term, corporate strategic plan. Competitive priorities are those strengths and capabilities (typically cost, time, quality, and flexibility) an operating system must possess to meet customer demand (Krajewski and Ritzman, 1996:29). Through a company's strategic planning process, each functional area is responsible for identifying means, or operations positioning strategies, to develop its competitive priorities to achieve corporate goals (Krajewski and Ritzman, 1996:30).

As a service industry, the military shares a common strategic operations planning framework with our civilian counterparts. This planning structure is shown in Figure 1. What differentiates the defense corporation as a service industry, amongst other criteria, is the absence of a profit maximization motive and instead, the presence of "doing what the nation wills." We do not generate revenues ensuring the solvency of our business but

we do spend the moneys appropriated to achieve the National Security Strategy (NSS) goals and objectives, our corporate market analysis and strategic map.

Operations Management Planning Framework

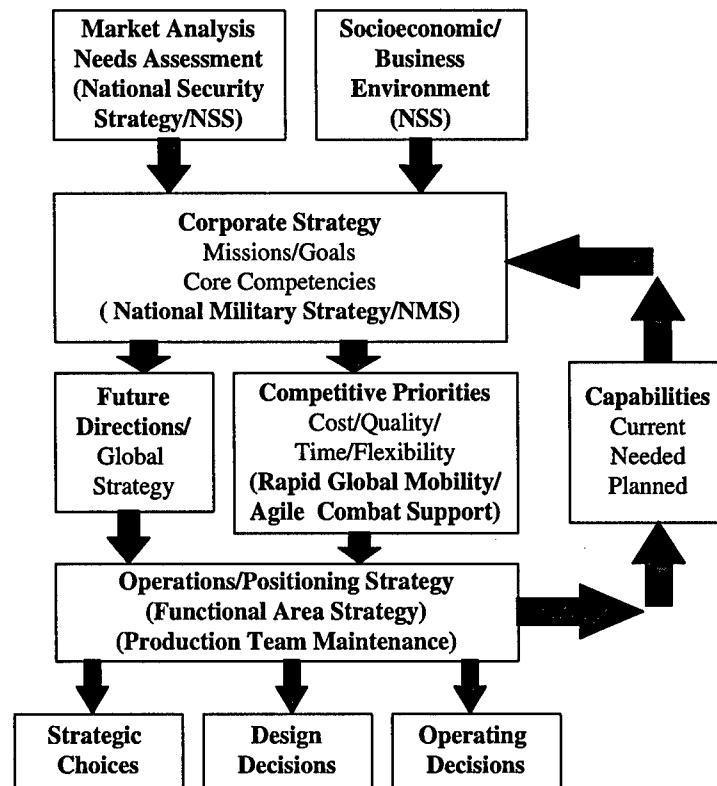


Figure 1. Major Components of the Defense Operations Management Planning Framework. (Krajewski and Ritzman, 1996:29 and 46)

The national defense corporation's market analysis renders many insights into our probable customers and their needs as well as our competitors' strengths. In passing from a bipolar geopolitical order to an unsettled multipolar world, new challenges surfaced. U.S. leaders believe the U.S. does not face an immediate threat to its national survival; however, interdependence and transparency coupled with our security interests make it difficult to ignore troubling worldwide developments. Many of our customers will likely be countries in need of food in water. With one-fourth of the world's population

projected to be suffering from starvation, regional conflict will be on the rise. Nationalistic, ethnic, and religious rivalries will also contribute to regional unrest. Political Islam may replace communism as the global threat to U.S. national objectives. Additional threats include illegal drug trafficking, terrorism, conventional and nuclear arms proliferation, and failed democracies and political reform prompting refugee flows. U.S. troops will deploy from the continental U.S. to support more humanitarian, peacekeeping, United Nation's, and coalition operations in remote areas with little infrastructure. Military operations other than war (MOOTW) will be the primary mission focus of AMC through 2015 (Moffit, 1996:10-13).

In the five years after the fall of the Berlin Wall, U.S. forces deployed forty times in support of security and humanitarian crises--a far greater pace than the preceding twenty years (Shalikashvili, 1995:2). This dramatic increase in operations tempo occurs when public policy is directing a decline in defense spending through the year 2000 then to level off until the year 2015 (Moffit, 1996:9).

Public Policy Factors in Operations Management Planning. In the post-Cold War period, there is a great deal of bipartisan public interest in national defense resource management. Republicans and Democrats alike want the 1997 defense authorization bill to require a new strategic review of force planning initiatives.

The bottom line is that the familiar path of the past--as convenient as it may be--will not necessarily lead us to the future we want to shape. I do not believe we can afford--either fiscally or strategically--to continue to tinker at the margins of our military forces or to procure

just the same sorts of Cold War systems in ever-diminishing quantities and at ever-increasing prices. (Pexton, 1996: 21)

If the public perceives less threat to national security, and consequently public interest wanes, less national resources are allocated to the common (defense) cause. This "peace dividend" is perceived earnings from a more peaceful international security environment.

If we hope to be able to maintain the support of our people for spending to protect our national security, we must be able to demonstrate that we have broken the chains of tradition and parochialism within the Congress, the executive branch, and in the military services, and are investing in a military force for the future, not the past.

As a nation, Americans acclaim three enduring national strategic goals: protecting the lives and safety of Americans both at home and abroad; maintaining the political freedom and national independence of the United States with its values, institutions, and territory intact; and providing for the well-being and prosperity of the nation and its people. In turn, more specific national interests requiring protection include enhancing U.S. security, promoting prosperity at home, and promoting democracy abroad. U.S. foreign and security policies are aimed at securing these interests through, for example, strong relations with our allies, protecting our rights of transit on the high seas, and enlarging the community of free market democracies (Shalikashvili, 1996:3).

While national goals and interests have not changed, the expectations of the nation's citizens for how we continue to secure them into the next century have changed. The public, as articulated in Defense Secretary Aspin's Bottom-Up Review defense guidance, is calling for a flexible force structure, not a scaled down Cold War force (Lewis and Roll, 1993:13). It is within the constraints of the national defense budget that we must engineer our defense posture.

Linking Corporate Strategies in the Military Complex

For PTM to be an effective positioning strategy, its structural and operational premises must be linked to the defense industry's hierarchy of strategies. As depicted in Figure 1, the strategies should cascade from top-to-bottom "providing a clear audit trail between high level national objectives and the capabilities (competitive priorities) of specific systems (concepts)" (Thaler, 1993: xi).

Periodically the question arises of which is more important, strategy or operations. The answer is usually strategy. While a firm can be efficient, it can fail if its strategy is off-base. Producing buggy whips after the invention of automobiles is not on target. Conversely, there are less efficient organizations that have succeeded because of an effective strategy. With clearly stated corporate missions, goals, objectives, and core competencies an organization can assume the appropriate competitive posture and develop congruent competitive priorities (strengths and capabilities).

The cascade of defense strategies forming the foundation of the PTM positioning strategy follows.

National Security Strategy. This past decade marks seminal years of sweeping worldwide sociopolitical change, not the least of which was the momentous breakup of the Warsaw Pact and the dissolution of the Soviet Union. One result of these far reaching events is the evolution of national security policy to a much broader concept far beyond military dimensions. Policy definitions include access to raw materials, particularly petroleum, the fight against terrorism and drugs, and the environment. Global economic competitiveness is on the rise and economic interdependence ensures all societies some

degree of necessary reliance upon each other's resources. Because our relationships with other major powers involve mixes of competition and cooperation, it becomes progressively more difficult to separate economic policy from foreign and defense policy. Inherent in this dependence is a desire to build trust between nations. And as degrees of trust ebb and flow with changes in political relationships, so do the considerations of national security strategies (Magyar, 1994:151-152).

Containment is no longer perceived as a suitable, all-encompassing goal of American security policy (Magyar, 1994:155). The threats of expansion of Soviet power as we knew it is no longer considered appropriate although arms control is still a highly relevant issue with regards to monitoring weapon proliferation. A proliferation expert, stated:

The possibility that the United states may face nuclear blackmail or assault has never been greater. When nations are ruled by despots who have little experience in crisis resolution and have a tendency to confuse personal ambition with the national interest, the likelihood of disaster increases dramatically. (Magyar, 1994:157)

Furthermore, the concept of deterrence in United States strategic policy was governed by mutual assured destruction doctrine. If each superpower was convinced the other could destroy their society in totality, no war would resume. The question today is whether or not this aspect of our Cold War doctrine has continuing utility to lend even marginal insurance in the conventional arena (Magyar, 1994:158).

The profoundly altered international security environment has shaken our traditional national security structural framework. To address threats that are uncertain and conflict that is probable and frequently unpredictable, the President and Secretary of Defense have espoused a strategy of engagement and enlargement of the community of free market

democracies (Shalikashvili, 1995:1). This national security strategy attempts to strike a balance between building a healthy global economic base and a viable military defense to counter military threats when non-military means alone cannot to the job (Magyar, 1994:152). The dangers the national security strategy identifies requiring military preparation are regional instability, the proliferation of weapons of mass destruction, transnational dangers (drug trafficking and terrorism), and the dangers to democracy and reform in former Soviet Union, Eastern Europe, and elsewhere in the world (Shalikashvili, 1995:1).

National Military Strategy. A military strategy of flexible and selective engagement was developed to support our nation's interests. It reflects the ambiguity of our security challenges and emphasizes the need for full spectrum capabilities. To guard against threats to U.S. interests, two national military objectives were identified: promoting stability and thwarting aggression worldwide through appropriate use of military capabilities in concert with economic, diplomatic, and informational elements of our national power. Three primary tasks will be performed by military units to support the military objectives. They include peacetime engagement, deterrence and conflict prevention, and fighting and winning our nation's wars. Accomplishment of these tasks is to be facilitated by the two complementary strategic concepts of overseas presence and power projection (Shalikashvili, 1995:i).

Being ready to fight and win the nation's wars has been singled out by our current military leadership as our foremost responsibility and the prime consideration governing all military activities. It is this task and Secretary of Defense Aspin's Bottom-Up Review

(September 1993) postulation that U.S. forces must be capable of fighting up to two major and nearly simultaneous regional conflicts (MRCs) that shape simulation scenarios used in higher headquarters' manpower models (Magyar, 1994:162). It is this definition of our primary military responsibility that sparks debate about appropriate force planning for the future. In light of the Joint Chiefs of Staff *Joint Vision 2010* template, many perceive the Bush Administration's Base Force and Bottom-Up review as a temporary holding station from Cold War posturing to whatever the shape of the armed forces may become in the next century (Pexton, 1996:18, Pexton, 1996, 21, and Shalikashvili, 1996).

Familiar Doctrine, Unfamiliar Demands. What do field researchers say? They first acknowledge the Air Force's basic doctrine as written today.

The Air Force is responsible for the preparation of the air forces necessary for the effective prosecution of war and military operations short of war...and for the expansion of the peacetime components of the Air Force to meet the needs of war. (Builder and Karasik, 1995:ix)

For more than forty years, ready forces were organized, trained, and equipped to prosecute a war to termination in hours or days to counter the Cold War threats.

Operations and mobilization short of war were treated as "lesser included cases." It is universally accepted that the international security threat has changed. The prospect of war remains but not a collision of two nuclear superpowers. Instead, the prospect of war is defined in terms of preparing for two nearly simultaneous MRCs. Unfortunately, our focus on large scale war has not. Military operations other than war (MOOTW) are still addressed as marginal issues (lesser included cases) as they were half a century ago (Builder and Karasik, 1995:13).

The dilemma is straightforward. While we restructure our forces for a two-MRC scenario, other sweeping changes besides a newly defined threat accompanied the end of the Cold War. On the one hand, defense spending has and will continue to steadily decline. It is now approximately 3.7 percent of the Gross Domestic Product and is forecasted to drop to a historic low of 2.8 percent in 2002 (Rhodes, 1994:1). This is less than any time since before Pearl Harbor. On the other hand, demands for using the U.S. military to help resolve ethnic conflict, civil unrest, and provide humanitarian and disaster assistance through MOOTW are on a very steep rise. Forecasters see a continuation of this trend with fewer military resources and more MOOTW demands even as mainstream U.S. defense planners focus on preparedness for two MRCs.

Builder and Karasik, in *Organizing, Training, and Equipping the Air Force for Crises and Lesser Conflicts*, delineate a particular type of MOOTW that is particularly stressing U.S. military forces. They refer to these operations as crises and lesser conflicts (CALCs): CALCs are nonroutine and international in scope and potentially lead to combat operations that do not develop into full-scale MRCs. In their estimation, CALCs may very well become the dominant form of operations other than war for defense planning just as MRCs are the dominant form of war for defense planning purposes (Builder and Karasik, 1995:xi).

The Center for Defense Information (CDI) published these conclusions (Rhodes, 1994:1-2):

- None of the wars going on around the world today endanger the United States.
- None of the current or foreseeable wars justify the Pentagon's plan to

maintain large, expensive Cold War military forces deployed around the world.

- The decline in war and the emergence of peace-seeking democracies around the world have enhanced the U.S. security.

The CDI goes on to recommend more reductions that would equate to cutting the Air Force to one-third of the 20 fighter wings existing in 1995 (Rhodes, 1994:2). Therefore, if we focus exclusively on a future dominated by two MRCs, the military may have the right kind of forces but not enough (sheer numbers of personnel) with no end in sight to budget cuts (Builder and Karasik, 1995:xii).

On the other hand, if we focus on operations other than war to include CALCs, although we may have enough "resources in the aggregate," we may not have the right "kinds" of forces (Builder and Karasik, 1995:xii). We are therefore presented with either (or both) quantitative or (and) qualitative problems.

This dilemma can no longer be masked by the past decade's massive numbers of Cold War forces structured for global war and very few operations other than war. MOOTWs cannot be treated as "lesser included cases" as the drawdown of combat and support forces and the increasing occurrence of CALCs have already stressed the MRC-designed (short in numbers) force structure. It is highly unlikely these unfamiliar MOOTW demands will "size" the combat forces, but there are strong indicators that organizational changes would offer the least cost, highest payoff responses to CALC mission requirements (Builder and Karasik, 1995:2). Division of basic responsibilities between active and the Reserve/Guard forces is considered most promising with active forces focusing on MOOTW and the latter heavily relied upon for the prosecution of war under

the mobilization leadership of the active component as it has been historically in peacetime (Builder and Karasik, 1995:xii and 31). Many of the Guard and Reserve traditional Cold War roles --fighter operations, combat communications, air traffic control, and civil engineering--have already been cut. New responsibilities include operating transport, tankers, heavy bombers, and airborne radar systems (Watkins, 1996:20). The changing mix of responsibilities is not new and many of the changes are being driven by the need to reduce the high pace of operations for active duty troops (Watkins, 1996:20).

RAND researchers suggest "active units need to be configured for deployments in smaller slices to meet the needs of a greater number of geographically dispersed operations, as opposed to being concentrated for one or two MRCs." Centralization (of national assets like strategic airlift, space, and reconnaissance) may make sense for MRC doctrine while decentralization may enhance CALC capabilities. In other words, a theater commander's resource "kit bag" may require varying configurations for the spectrum of conflict. The dilemma for leadership is the opposing imperatives that MRCs and CALCs present. Leadership's challenge is to design an Air Force that can operate efficiently in MRCs but can also be "sliced", people and equipment, for more fragmented operations to support simultaneous CALCs. An Air Force designed to deploy and fight as a wing or squadron may provide more than is needed in CALCs. If a flying unit's primary equipment is needed in two geographically separated locations, can maintenance personnel and other support functions also be split (Builder and Karasik, 1995:37)? An Army officer put it this way:

The Army fights by divisions. When the Army thinks of its logistical needs, it thinks in terms of division slices. The Army knows how to supply a division with artillery shells, but we do not know what a battalion slice looks like. There is no such thing. (Builder and Karasik, 1995:38)

The best "tooth-to-tail" ratio for each active unit will need to be delineated while preventing deterioration of combat readiness performance that could occur from extended involvement in peripheral peacetime engagement activities (Builder and Karasik, 1995:32).

Congressional leaders requested a response from the Air Force regarding a "tiered" readiness plan to cut operating and training monies to support modernization programs. Only deployed or first to deploy units would be maintained at peak training, manning, and supply levels. Second and third tier units would be maintained at lower readiness levels (Maze, 1996:20).

The Air Force's Air Expeditionary Force (AEF) models this concept to some degree. Each AEF would be a tailored, combined force (fighters, tankers, and bombers "on a string" at home base) deployed overseas for a limited time to provide presence and conduct operations. General Fogleman, Air Force Chief of Staff, envisions one AEF "at the ready" in the continental U.S. (CONUS) while one is deployed in the field "as the norm." To keep a "reasonable operating tempo," two AEFs in the field and one on call would be the maximum available. Personnel tempo rates may increase but the operations tempo will probably be the same with or without AEFs. The AEF was created because "in a world of less resources, we've got to find a way to satisfy U.S. global commitments" (Tirpak, 1996:40).

The selection of big wars or of little wars as the primary focus for the U.S. military requires a major shift in national security thinking (Builder and Karasik, 1995:31). Today our National Military Strategy states the U.S. will retain formidable forces despite the ten-year drawdown to date. U.S. forces will be postured and sized "to achieve decisive victory in two nearly simultaneous major regional conflicts and to conduct operations characterized by rapid response and a high probability of success" (Shalikashvili, 1995:17). The two-MRC requirement is considered the "principal urgent diet" of the military. Efforts are focused on organizing, training, and equipping forces for the two-MRC scenario although "forces to provide adequate overseas presence...have also been taken into account" (Shalikashvili, 1995:17). Operations and mobilizations short of war continue to be handled as issues on the margins of Air Force priorities (Builder and Karasik, 1995:ix-x).

Air Mobility Master Plan-97. This master plan is AMC's 25-year strategic plan developed to focus the organization's efforts on our capability to transport forces worldwide to support America's national interests. The end of the Cold War ushered in a more vigorous role for air mobility than ever before in history. "Airlifters and tankers ...have become the first weapon of choice in peace and war, and are a key element of every on-going military operation" (HQ AMC/XP, 1996). Command decision makers use the AMMP as a management tool to program and budget for future year operations, people, infrastructure, and equipment. It supports the national security and national military strategies across the spectrum of conflict, from nuclear deterrence and major regional contingencies to peacetime engagement operations. The plan identifies three

primary operational objectives: force sustainment, power projection, and operations other than war within the air mobility mission area. Associated operational tasks and key processes are detailed, defining the command's operational capability (HQ AMC/XP, 1996:1-9).

A changed international landscape and tightened fiscal constraints on the homefront requires forces to be primarily based in the continental U.S. (CONUS). CONUS forces now depend heavily on the speed and flexibility of combined air refueling and airlift capabilities to deploy, employ, and sustain combat forces worldwide. This ability to rapidly project power is essential to establishing or reinforcing a secure U.S. or multinational presence with the greatly diminished forward presence. With a continued, brisk operations tempo forecasted, air mobility forces will be the cornerstone of America's security strategy, delivering the bulk of the initial time-critical forces (HQ AMC/XP, 1996:1-9).

To support air mobility missions, training and alignment of maintenance personnel under the PTM structure are aimed at: (a) reducing the number and variety of technicians required to perform a task, and (b) reducing the deployment footprint. The goal is to "Maximize logistics training resources to maintain 75% trained/experienced level work force for each weapon system and specialty code" (HQ AMC/LGQ, 1996: 3-20). While accurate measures are not currently available in personnel or logistics information systems, maintaining 75 percent of the maintenance work force trained and experienced is speculated to be adequate to meet mission requirements. The training and experience levels are generally considered to be adequate at most AMC bases. It is the intent of the

AMMP to provide the roadmap to implement the United States Transportation Command's (USTRANSCOM) human resource development program to ensure forces are structured accordingly (HQ AMC/XP, 1996:3-21). USTRANSCOM's "Goal 001: People" includes a human resource development program objective "that ensures the right number of people, with the right knowledge, skills and abilities, are available throughout the Defense Transportation System" (Rutherford, 1996:9).

Logistics Strategy Plan. The AMC Logistics Strategic Plan is a road map integrating all higher headquarters' (Department of Defense Logistics, U.S. Transportation Command, Air Force Logistics, and AMC) logistics visions, missions, goals, and objectives. The Department of Defense (DoD) mission "To provide responsive support to ensure readiness and sustainability for the Total Force in both peace and war," is threaded throughout the subordinate military commands' long-term strategic plans (Moffitt, 1996:2). A common goal of both the unified and service commands is the implementation of a human resource development program that ensures a "right-sized," technically competent logistics force that is smaller, more versatile, and ready to respond on a moment's notice (Moffitt, 1996: 3, 5, and 7). The AMC Logistics Directorate, as mentioned in the AMMP-97, plans to maximize training resources to maintain a 75 percent trained and experienced work force for each weapon system and AFSC assigned. In addition, USAF Logistics encourages functional logistics managers to continue to shift the focus from a stovepiped disciplinary approach to a truly integrated logistics process. Thus, the emphasis on training maintenance personnel in families of skills (cross-

utilization training) to develop a versatile, reliable, and proficient force (Moffit, 1996:5, 12-13).

Power projection and force extension will remain a cornerstone of U.S. national security strategy across the spectrum of conflict.

As the U.S. force structure continues to shrink, AMC's strategic mobility mission will become even more essential. Increasing involvement in simultaneous humanitarian, disaster relief, peacekeeping, and peace enforcing missions will tax AMC's capabilities. For AMC logisticians, the challenge is to support AMC aircraft, operating out of remote airfields with little or no infrastructure or U.S. presence, with fewer logistics personnel. (Moffit, 1996:12)

Core Competencies and Competitive Priorities

To attain our national security objectives with fewer logistics personnel, the Air Force Chief of Staff specified six critical capabilities or core competencies that could make aerospace power "decisive." Two of these, rapid global mobility and agile combat support, are pertinent to this research. USAF units must be able to move rapidly to any spot on the globe with fewer and leaner logistics forces. Forces will become more expeditionary and capable of providing strong combat support for sustained combat operations (Dudney, 1996:24-26).

Not unlike businesses in the market system, developing these competencies necessitated identification of AMC's competitive priorities, those strengths AMC's operating system must possess to meet customer demand and gain an advantage by outperforming our competitors. Stated differently, AMC translated its core competencies

into operational terms: cost, time, quality, and flexibility (Krajewski and Ritzman, 1996:29). AMC intends to achieve:

- lower operational costs by technological insertions that will decrease resource requirements and minimize the logistics footprint--deploy lean and mean.
- responsiveness by projecting power rapidly (in hours or days not weeks) a decisive place and time.
- higher quality by increasing equipment reliability and performance.
- flexibility by customizing, tailoring and paring, modular combat service packages in response to wide-ranging contingency requirements.

These AMC competitive priorities provide the necessary inputs for functional level (base level) operations strategies. The core of an operations strategy is the positioning strategy which determines how the operations system is organized and the nature of the operations required to accomplish organizational goals. In AMC, PTM was the maintenance production positioning strategy developed to achieve corporate goals.

Linking Corporate- and Operations-Level Strategies

As strategies cascade to lower levels of management, broad-based goals and objectives become more clearly defined as specific operational tasks like those listed in the AMMP-97. Even so, making the leap from the more general higher headquarters' strategic plans, goals, and objectives to the development of effectively postured operational level strategies is often the most difficult hurdle for functional level managers. While corporate-level strategies link the military to its external national security environment, it is the internal, functional-level operational strategies and tasks that determine how responsively and how efficiently objectives are attained through implementation of a

strategy (Gray and Smeltzer, 1989:189). "No one ever made a nickel of profit by making plans; profit flows from the implementation of plans" (Gray and Smeltzer, 1989:204). The management tool used by AMC to link corporate-level strategies to maintenance operations is the Logistics Composite Model (LCOM).

The LCOM: An Integrated Logistics Model. One means of developing a responsive operational structure is accurate determination of manpower requirements for the future logistics environment. Strategic planning trends and assumptions can be integrated into automated simulation models like the Logistics Composite Model (LCOM). The only limitations to criteria considered would be those inherent to the automated simulator hardware and software capabilities.

The more than 20-year old model is fundamentally a computer-operated simulation capable of tracking through various logistics tasks required to prepare aircraft for specified missions. This simulator, like most other similar models in the field, is skewed toward quick-response functions more critical to combat support logistics than to the more general peace-time applications (Battilega and Grange, 1978:442). Differing levels and combinations of resources are tested to (Battilega and Grange, 1978:476):

- evaluate the effectiveness of a prescribed set of resources (aircraft, parts, equipment, facilities, and personnel) in accomplishing a specific mission order.
- find the least-cost mix adequate to meet flying requirements.
- determine adequacy of a somewhat constant mix and level of resources representative of a hypothetical plan over various scenarios. Range of suitability and limits of acceptable performance would be examined.

A key characteristic of the LCOM is the assumption that all logistics activities occur at a self-contained aircraft servicing and repair point. Therefore, all aircraft are assumed able to share resources. The Navy modified the basic LCOM to enable the development of any number of duplicate aircraft carriers (bases). The simulator can produce a required number of exact copies of the one aircraft carrier (base) described. This attribute is especially appropriate when forces will be fragmented into multiple, small units. Intuitively, managers know support requirements will be less efficient and more redundant than when economies of scale can be appreciated. This fragmentation of forces, or "slicing," is at the core of the LCOM implementation challenges. Air Force managers must now simultaneously accomplish multiple, back-to-back peacetime engagement missions (Battilega and Grange, 1978:479).

There are two core modules embedded in the simulator: the Decision and Forecasting Modules. Unlike conventional simulation applications, the LCOM decision module permits the user to automatically adjust on-hand quantities of resources during the model's run to accomplish a specific performance goal. Further, it jointly determines which resources can be increased at least cost and which resources are probably prompting the most performance difficulties. Within allowed budget constraints, the Decision Module automatically increases selective resources to ensure the most cost-effective solution. However, surplus resources are not automatically accounted for and must be forced into the system to attain a more accurate least-cost allocation (Battilega and Grange, 1978:480).

The Forecast Module activates the Decision Module. This module attempts to stay ahead of resource demands by observing user-specified performance parameters over time and predicting needed future levels of the desired parameters. Exponential smoothing and regression analysis is applied to predict performance in a future period as the module flows through a time series of observations parallel with simulator operations (Battilega and Grange, 1978:480).

There are an infinite number of potential model environments available to the user. This flexibility dictates the need for users to carefully identify what questions truly need to be answered, understanding it would be impossible to replicate a real-world operation in every detail.

Users must also comprehend the interrelationships among the model's application of networks, tasks, and resources. Networks establish a pattern and control sequence for accomplishment of tasks. Tasks, on the other hand, define the resources necessary for a particular event and the effect of that event on available resources (Battilega and Grange, 1978:481).

The LCOM simulator is the core of the system and is the element that users manipulate to configure a model that best resembles the operations they must support. System characteristics include (Battilega and Grange, 1978:477-479):

- a mission order, one of a time-ordered series, which makes a demand for a type and number of aircraft to be launched at a specific time in the future.
- required aircraft to be processed through pre-sortie tasks and upon return from a mission, processes the aircraft through post-sortie tasks.

- tasks (duration and resource requirements) associated with one or more task networks. Task networks define which tasks proceed in or sequentially.
- resources that may be aircraft, parts, equipment, facilities, or people. Resources may be consumed, returned for re-use, or created.
- the need for a specific task to be deterministic or stochastic (probabilistic).
- finite inventories that are applied in task executions thus impacting task completions.
- resource outages that can be resolved by accepting a suitable substitute, wait for a repaired part, wait for re-supply, speed up repair process, preempt a repair in progress, or cannibalize.
- shift changes that may impact resource availability. Limits on over-time are applied.
- missions which are started if enough aircraft are available. If not, the mission is delayed. The Navy and Air Force models' modifications account for airworthiness as defined by service-specific mission essential systems lists.
- aircraft which return at the scheduled time and generation of post-sortie tasks.
- data collection and reporting record information about success, delay, and failure. Data includes: mission accomplishment rate, aircraft non-availability, sortie rate, man-hours available, man-hours overtime, man-hours per flight, reparable generated, average repair cycle times, supply demand fill rates, number of backorder days, and equipment usage rates.

The detailed cross-functional model requires very extensive input. It facilitates mission priorities, support capabilities, and operation feasibility as measured by the number of combat-ready aircraft.

AMC KC-135 LCOM Application. The KC-135 LCOM Final Report, Peacetime and Wartime, was AMC-approved on 1 May 1995 for field implementation. This

document is the first AMC KC-135 LCOM. The basis for the study was the LCOM KC-135 database developed by Strategic Air Command (SAC) prior to its deactivation. Due to fiscal constraints, manpower standards derived from the LCOM were never approved by SAC. After a field visit to Plattsburg Air Force Base in 1993, it was determined that more current maintenance data was not representative of normal expected aircraft reliability. DESERT SHIELD/STORM and subsequent intensive peacetime airframe commitments seemed to skew the data. After verifying the October 1989 reliability and maintainability components of the model, current AMC missions, RIVET WORKFORCE AFSC structure, the objective wing organization, PTM and other policy decisions occurring during the standards development process were incorporated into the SAC database. Requirements reflected the greater of the peacetime and sustained wartime requirement by flight. The surge and contingency objective utilization rate for the KC-135 was considered the same as its wartime sustained rate and therefore, was not addressed separately in the LCOM report (HQ AMC/MEF/XPMEM, 1995:1-3).

The peacetime scenario was based on historical mission data and planned aircraft utilization. The peacetime objective was 1.25 flying hours per day. Sixteen sets of homestation requirements based on various numbers of primary assigned aircraft (PAA) and flying-hour combinations were simulated (HQ AMC/MEF/XPMEM, 1995:1).

The sustained wartime scenario modeled a recovery maintenance facility (RMF) supporting forward operating locations (FOL-bare base) similar to DESERT SHIELD. A typical RMF would support 84 aircraft operating out of seven to twelve FOL squadrons. The wartime objective was 1.5 sorties per day, averaging 4.5 hour sortie durations or 6.75

flying hours per day per aircraft. Ten sets of FOLs with various PAA and flying-hour combinations and five RMFs supporting different PAA were simulated. Peacetime deployments to support exercises and other DoD requirements were not modeled (HQ AMC/MEF/XPMEM, 1995: 2 and Attachment 1:1 and 7).

Maintenance manpower was determined to be the greater of its peacetime, contingency, or sustained operational environments aggregated by AFSC. Flight line AFSCs included crew chiefs and the following specialists: communications and navigation, guidance and control, electro-environmental, pneudraulic, and propulsion. A mixture of two and three-level maintenance by subsystem with no cross-utilization was modeled. Shift profiles were 7-day weeks, peacetime 3 to 8-hour days (87% manpower utilization) and contingency and sustained 2 to 12-hour days (89% manpower utilization). In general, maintenance requirements and policies assume adequate support equipment and parts resupply. Aircraft attrition and aircraft battle damage repair was not modeled. The LCOM process was accomplished for current KC-135 basing at Fairchild, Grand Forks, Malmstrom, and McConnell Air Force Bases (HQ AMC/MEF/XPMEM, 1995: 2 and Attachment 1:1-7).

Not unlike the airlifter LCOM, the sustained wartime (fully mobilized) scenario is based on 1994-99 Defense Planning Guidance Major Regional Contingency (MRC)-Europe (Moffit, 1993). It was considered the most demanding scenario in the official guidance for maintenance manpower due to shorter sortie lengths and therefore, more ground servicing and handling events. The scenario also includes missions to satisfy concurrent airlift requirements in the Pacific theater. The LCOM presents an

organizational structure formulated from both the peacetime flying hour program and the two nearly simultaneous-MRC wartime scenario and nothing in between. The “nothing in between”, MOOTWs, is what unit managers are responding to on very short notice (rapid response).

Our nation’s peacetime engagement strategy acknowledged “...a world in which regular warfare seems less likely than the disorders and human tragedies that are increasingly emerging everywhere” (Builder and Karasik, 1995:xviii). The LCOM assumes any force adequate for major regional contingencies (global or regional wars) would also be adequate to meet force requirements for operations other than war. Therefore, unit “kit bags” of resources are accordingly sized for “regular” warfare not MOOTW.

When the KC-135 LCOM was run, 653 positions were generated, some of which were PTM-earned, as a result of the weapon system’s transition from a SAC to a MAC orientation.

During the development of the manpower standards in this report, every effort was made to account for all work associated with aircraft maintenance. However, during the standard development process, a number of policy decisions (PTM) were made which affected the maintenance requirement. In lieu of interrupting the process or even starting all over, requirements generated by these policy decisions are treated as variances to the requirement... (HQ AMC/MEF/XPMEM, 1995:5)

The PTM variance was used to ensure appropriate coverage to meet mission requirements when the LCOM-simulated requirement did not provide adequate shift coverage or when it did not consider training requirements or skill-level distributions to meet training requirements (HQ AMC/MEF/XPMEM, 1995:5). PTM’s final structure

was driven by resource-based factors. In addition to the KC-135 positions, AMC decided to pay a manpower bill equal to over 200 positions for the C-141 weapon system (HQ AMC/MEF/XPMEM, 1994).

In a 3 August 1994 memorandum, the HQ AMC Director of Logistics summarized the LCOM manpower requirement as one reflecting "...many organizational, maintenance policy, and force structure changes that have been implemented over the past several years" (Moffitt, 1994). Some of the major changes embedded in the LCOM calculation include (Moffitt, 1994):

- The RIVET WORKFORCE AFSC Restructure: Many different aircraft maintenance AFSCs were reduced and consolidated to support each weapon system.
- Objective Wing Structure: This structure offsets much of the home station savings of RIVET WORKFORCE. It transfers some historically pure maintenance functions (i.e., job control) to other wing functions. Eliminates component repair and equipment maintenance squadrons and establishes maintenance squadrons.
- Production Team Maintenance: This is a HQ AMC/LG initiative to increase the effectiveness of the sortie generation flight by ensuring a balanced (by AFSC) team assignment to specific aircraft 24 hours per day.
- Equipment Excellence Inspection: This initiative was developed to revitalize command support equipment.
- Centralized Training Management Function: Includes maintenance training for qualification and cross-utilization training.
- Two-Level Maintenance (2LM): The full implementation of 2LM will remove significant maintenance workload from the wings in avionics and jet engine repair.

All of the above organizational, maintenance policy, and force structure changes made in the past decade were intended to either increase effectiveness or efficiency with a force streamlined from a decade of budget reduction initiatives.

PTM: AMC's Maintenance Production Positioning Strategy

PTM is defined in AMCI 21-101, Maintenance Management Policy, dated 15 June 1995, and is quoted in full in Chapter 1 (HQ AMC/LGQP, 1995:30-31). Instructional guidance is specific, defining standardized wing organizations across all airlift and tanker base level units. Standardization was intended to fill the gap identified in the 1993 AMC "how-goes-it" white paper which documented the maintenance assessment conducted in the aftermath of the Travis Air Force Base C-141 fire. As General Moffit stated, the organizational turbulence of the 1990s appeared to have ushered in a period of "county options" resulting in non-standard wing organizations with significant variances wing to wing (Moffitt, 1994). Organizational stability had been shaken by a series of comprehensive back-to-back restructuring actions. Major restructuring events are listed below in Table 1.

Table 1. Timeline of Maintenance Restructuring Initiatives

1989: RIVET WORKFORCE restructured maintenance specialties

1991: (Fall) Air Force objective wing structure approved

1991: Flight line maintenance moved under operations group (OG) commanders

1992: USAF approved AMC strategic airlift AGSs to go under OG

1992: (Jun) Air Mobility and Air Combat Commands "stand up"

1993: (Oct) Travis AFB C-141 burns to the ground

1993: (Nov) Integrated Tanker Unit Deployment concept implemented

1993: (Fall) AMC/LG directed maintenance assessment/results "*alarming*"

1994: (Feb) NAF/CC's tasked to assess maintenance/put maintenance in AGSs under the LG (one wing dissented)

1994: (Oct) NAF reassessment/similar results but even more pronounced and AF/IG inspection followed with same "*alarming*" results

1994: (Oct) AMC LG/DO/XP concur maintenance should be realigned in AGS under the LG

1995: (Feb) USAF approved AMC to realign maintenance AGS under the LG

1997: (Apr) CONUS C-130s realigned under AMC and AMOGs restructured

The implementation of PTM followed suit--its structure varied from unit to unit.

When AMC Regulation 66-1, "Maintenance Management Policy," was revised, we incorporated the USAF philosophy that wings should generally be told what needed to be done, not directed how to do it. The message received during our assessment visits indicated we had gone too far in limiting guidance. In the worst cases, we had eliminated vital programs... Units were responsible for not having taken the responsibility to build/ supplement necessary programs. Maintenance and operations were confused in regards to specific maintenance responsibilities in the "new" objective wing. The atmosphere was frustrating for both workers and

managers. (Moffitt, 1994)

No less than four reorganizations within a five year period occurred, directly impacting the conduct of maintenance production activities. In the Fall 1994 15th and 21st Numbered Air Force assessments, the recommended optimum organization for both airlift and tanker generation maintenance units was placement under the Logistics Group in aircraft maintenance units (AMUs) under aircraft generation squadrons. Per the 21st Air Force Commander (21 AF/CC), "the AGS would be best aligned under the LG for span of control, structure, flexibility, mission focus, and senior officer oversight." The 15th Air Force Commander (15 AF/CC) stated, "Our units are making the current structure work but there are definite shortcomings" (Moffitt, 1994). They are summarized below:

- Single 0-6 oversight and focus is needed.
- The current objective wing gives us day-to-day sortie generation but does not emphasize overall fleet responsibility--the long term health of the fleet.
- The trend to "super" wings (tankers/airlifters) favors a single "belly button" for our maintenance effort.
- We need to "pool" maintenance resources together to get the needed flexibility and synergy. Consolidation is more efficient in a downsizing force structure.
- Alignment of maintenance under the LG corrects the fragmented headquarters and field communication driven by maintenance under the LG at higher headquarters and under operations in the field.

While macro-level destabilization occurred, flight line level maintenance production activities were also adjusting to the consolidation and elimination of AFSCs. PTM was,

in part, AMC's response to AFSC restructuring. PTM was implemented with an emphasis on crew chiefs augmented by small numbers of specialists. Deliberate conversion of manpower authorizations would occur as the system matured to more heavily balance the workforce to a specialist-oriented, CUT-trained structure (Fromm, 1993).

Standardized Unit Manning Documents (UMDs) reflecting standard work center authorized manning levels and manpower conversions had not been formalized. Manning levels within and between work centers were left to the discretion of local managers during the massive transitions of the 1990s. The significant differences that emerged with some wings "maintaining formidable structures in backshop work centers (and consequently operating with fewer available manpower resources on the flight lines) while other wings leaned in precisely the opposite direction" (Fromm, 1993) was expected. However, at publishing of the 1993 maintenance training white paper, AMC felt they had corporately developed "...a pretty good feel, based on observing wing performance and their progress in implementing PTM, for how low we can drive backshop manning in order to augment flight line availability, all while preserving effective intermediate maintenance capability" (Fromm, 1993).

Seven months later when the Travis Air Force Base C-141 burned, the AMC Logistics Commander's-directed maintenance assessment found:

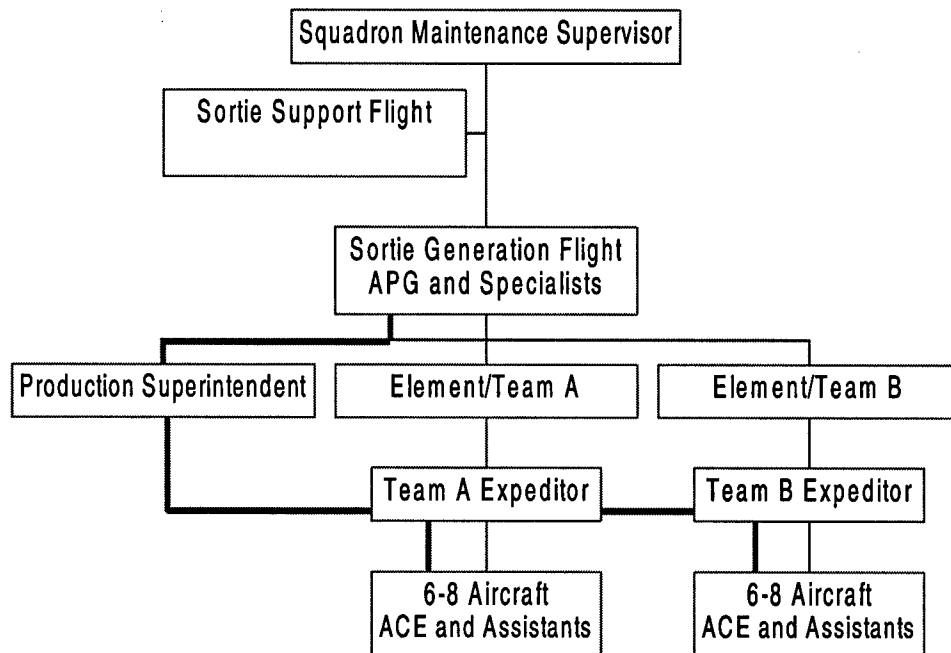
AMC's Production Team Maintenance (PTM) organization was poorly defined and required a mix of specialists and crew chiefs not supported in UMDs. PTM required core flight line task training of all AFSCs to enable them to perform basic flight line general tasks. Personnel were aligned in production teams encompassing all flight line AFSCs. Lack of written

guidance left units in a dilemma in regards to whether or not these teams were assigned to individual aircraft or groups of aircraft. Temporary retention of specialist flights was authorized as a means to transition to PTM. Very few units advised us they wanted a specialist flight option, yet most units were operating with separate specialist flights--despite their own charts showing PTM organization. This sent a conflicting message to the folks on the line. (Moffit, 1994)

AMC recomputed the C-141 Logistics Composite Model (LCOM), an automated maintenance manpower standards program, based on PTM teams servicing single, four, eight, and sixteen aircraft groupings. AMC was willing to pay the manpower bill at the six to eight aircraft level. Therefore, there would generally be two expeditors per shift, per sortie generation flight, serving as the PTM "chief" responsible for a team of mixed AFSCs assigned to six to eight aircraft (Moffit, 1994). PTM inefficiencies were recognized, resulting in the decision to fund more airlifter authorizations (over 200 command-wide), move specialists to the flight line from backshop maintenance, and convert crew chief positions to specialist authorizations (Sherouse, 1996).

The decentralized maintenance concept readdressed four of the six 1989 MAC PTM guiding principles. Backshop specialist flight dispatch functions were disbanded (eliminated their "union" cards), crew chief authorizations would be converted to specialist authorizations to enhance specialist availability, sortie-producing specialties were integrated into cohesive units called production teams, and PTM members representing all specialties would report to a PTM chief, the expeditor. The other two guiding principles required separate management actions: (a) CUT training flight line maintenance personnel, and (b) establishing a job control coordination center (Sherouse, 1996). Figure 2 depicts the PTM organizational wiring diagram.

Production Team Maintenance



**Figure 2. Production Team Maintenance For a 12-16 PAA Flight.
(HQAMC/LGQP, 1995)**

PTM, AMC's proposed operations management maintenance production positioning strategy, was a team concept intended to maximize potential production and training potential in light of the forthcoming and continuing drawdown of personnel. As mentioned earlier, it was primarily a resource-based initiative integral to the RIVET WORKFORCE era. AFSC consolidations were being conducted to broaden responsibilities of underutilized specialists in the backshops and place them on the flight line to support the increased operations tempo. What may have been lost in the fog of

having to react so quickly to budget reductions was assessing PTM's compatibility, its link, to post-Cold War defense strategies and operational tasks

Other Command Policies Impacting PTM

Integrated Tanker Unit Deployment. In November 1993, the AMC Vice Commander released a message stating "Tankers must step up to a new level of effort that sees not only a five-fold increase in temporary duty (TDY) requirements, but a new and rapidly expanding role in airlift." Since 1986, the active duty tanker fleet experienced a 50 percent decrease in aircrews and a 500 percent increase in peacetime TDY deployment taskings. The command prescription was long-range scheduling (a year) and the Integrated Tanker Unit Deployment (ITUD) concept. Units could plan ahead, provide a more stable operating environment, and in the future, be relieved of their Single Integrated Operations Plan when tasked for an ITUD (HQ AMC/CV, 1993).

The ITUD was an initiative designed to improve how AMC managed tanker resources at the squadron, group, and wing levels. At this point in time, maintenance had been officially aligned under operations for nearly two years. Under the ITUD concept, wings would be tasked for deployments on a rotational basis (ideally 90 days). Wings, in turn, sub-tasked the ITUD to an integral squadron with shortfalls made up by the wing. Rotations of all unit personnel at the 45-day point was permitted and aircraft were to be assigned to a task force from a health-of-the fleet perspective by forecasting periodic inspections (HQ AMC/CV, 1993).

A year after implementation, field comments were solicited by the AMC Director of Operations. It was reemphasized that unit integrity would be maintained to include

aircraft and personnel to “capture the synergistic benefits of allowing units who train together at home to operate together when deployed...and also allows unit commander to provide continuity of command to their deployed forces” (HQ AMC/DOO, 1995).

Theater tanker requirements were based on worst case scenarios giving rise to disparity between actual operational requirements and the UTC package itself. Commanders requested a reduction in standing tanker requirements to keep deployments to a minimum. A related issue was the inability of commanders to swap out an AFSC not on the deployment requirements document. Commanders could submit a manpower and materiel package paring the standard UTC prior to deployment to the supported theater for validation (HQ AMC/DOO, 1995).

The ITUD concept remains in place today although maintenance personnel were realigned under logistics in 1995. Maintainers are assigned to sortie generation flights within an aircraft generation squadron. Flights are “aligned” to operations squadrons and every effort is made to deploy integrally, personnel and aircraft.

This operational structure was not an input to the LCOM nor is it applicable to strategic or tactical airlift units.

120-Day Personnel Deployment Policy. Efforts to balance the operations and personnel tempo are ongoing. However, support for additional operations (no-fly zones, air refueling bridges, monitoring illegal drug trafficking) are expected to increase. While the command is committed to supporting these and other operations, AMC is working to reduce high personnel tempo to below the maximum desired level of 120 deployed days per year per person. Three initiatives are underway: (a) global sourcing of active duty

units regardless of theater assignment, (b) a tasking prioritization protocol to be used for consideration of relief or substitution, and (c) integration of the Air Force Reserve and the Air National Guard (Widnall, 1996).

In the meantime, units report deployment statistics and juggle their resources by specialty and skill level to fulfill all peacetime training and contingency commitments. With emphasis placed on equitable distribution of the TDY workload, unit commanders have expressed a diminishment of their authority and discretion to select individuals to deploy on a specific operation or to deploy personnel in excess of 120-day standard (HQ AMC/DO, 1997). This policy was not included in the LCOM simulations. It is applicable to all air mobility personnel.

Training Policy. Air Force training policies generated from the objective wing restructuring, officially referred to as the Year of Training initiatives, continue to slow the process of adjusting the imbalance (skill levels) of trained and experienced maintenance specialties needed to implement PTM. This imbalance can be attributed to several factors including post-Cold War separation incentives (VSI, SSB, and the early retirement program), relocation of entire units to different bases, base closures. All of these exacerbated the normal cycle of accessions, rotations, cross-training, separations, and retirements. There are estimates that up to 60 percent of today's Air Force has turned over since 1990 (HQ AMC/XP, 1996:3-19-20).

The Year of Training initiatives added an experience requirement of 18 months to upgrade training in conjunction with the rank and formal task qualification and certification requirements. There is also a mandatory, two-week, non-task oriented

seven-level school (with a backlog of up to one year) required before award of seven-level certification. Therefore, it can take from 18-30 months for personnel to be upgraded to seven-level craftsmen. Although the intent was to add a period of supervised, hands-on training to reinforce the mandatory task requirements and permit upgrade trainees to gain confidence with their newly learned skills, it was implemented at a time when five- and seven-level technicians were given incentives to separate. Maintenance, like many other AFSCs, was gutted of trained and experienced second term airmen. In addition to the separations, personnel were relocated to bases without regard to their weapon systems.

...Of primary interest are the various personnel policies which force personnel out of their weapon systems, place overseas returnees at locations with minimal regard for weapon system experience, and force retrainees into technical career fields with minimal formal training. (Fromm, 1993)

Reductions in the defense budget continue, requiring

...the need to restructure maintenance AFSCs and align training to support PTM. The goals are to reduce the number/variety of technicians required to perform a task and to minimize the number of technicians required for deployment. (HQ AMC/XP, 1996: 3-19-20)

Summary

This chapter provides the historical backdrop and groundwork necessary for analyzing PTM's viability, strategically and operationally, as a field-level operations management production concept. Understanding how PTM evolved to its current status sets the stage for the analysis in Chapter 3, Assessment and Findings, of the factors adversely impacting its maturity to full implementation.

III. Assessment and Findings

Introduction

To accomplish strategic- and operational-level assessments of PTM, five implicit assumptions integral to PTM are identified and defined. These assumptions, which operationally clarify the command instructional definition of PTM documented in Chapter 2, have directly contributed to the inability of the KC-135 tanker community to fully implement PTM.

Two assessment methods are used in this chapter. They are strategic control and the Theory of Constraints (TOC). The strategic control assessment analyzes the PTM positioning strategy within the prescribed operations management framework. Suggested disconnects between PTM and the corporate defense hierarchy of strategic-level goals and objectives indicate a historical pattern of parallel development. In contrast, the operational-level TOC assessment examines specific constraints adversely impacting the evolution of PTM as a viable field-level positioning strategy capable of achieving corporate-level strategic goals and objectives. Identification of several constraints impeding full implementation of PTM lend insight to PTM's "still evolving" viability and "fit" in the field.

PTM Assumptions

There are five implicit assumptions integral to AMC's current definition of the notional PTM model that continue to adversely impact its successful implementation and execution in the field. They are as follows:

- By-name assignments are made for element-level production teams for each shift. The sortie generation flight's wiring diagram should mirror flight line production activities.
- Production teams should maintain team integrity within a given element, and therefore, by shift within an element. Management will promote a "reasonable" degree of "membership" and longevity to stabilize both production and health of force (supervising, rating, and training) activities.
- Production teams, by element by shift, should be a mix of specialties and should be self-sufficient.
- Sortie generation flights (SGFs) establish and maintain team integrity by aircraft assignment. Personnel are assigned to a group of six to eight aircraft which constitute one of two elements within an SGF. Production teams are selected to deploy with their six to eight aircraft.
- Aircraft selected for deployment are chosen to promote the PTM concept. Deployment aircraft will be assigned from the same flight.

These implicit assumptions were extracted from references in this paper and field experience with PTM implementation efforts. Although not listed specifically in maintenance management policy instructions, these assumptions require compliance to implement and execute PTM as currently defined. If operations managers are not adhering to these assumptions, PTM is solely a theoretical concept, a paper exercise, with no viable, practical operational field application. According to the HQ AMC/LG, at the turn of the decade:

AMC's Production Team Maintenance organization was poorly defined...Lack of written guidance left units in a dilemma in regards to whether or not these teams were assigned to individual aircraft or groups of aircraft...most units were operating with separate specialist flights--despite their own charts showing PTM organization. This sent a conflicting message to the folks on the line (Moffit, 1994).

Paradoxically, while these five implied assumptions lend operational credence to AMC's notional PTM concept and more explicit definition to team composition, it is probable that these underlying premises are the impetus for the perpetuation of bottlenecks in field application of PTM. These assumptions continue to constrain operations managers' abilities to fully implement PTM four years after the 1993 major command evaluations (Fromm, 1993, Moffit, 1994, and HQ 15 AF/SIB, 1993).

Strategic Assessment of PTM

Strategic Control Methodology. To assess the viability of the application of PTM to the KC-135 tanker maintenance community, the strategic control method is used to determine whether the strategic course being followed should be modified in light of changing conditions. The evolution of PTM is examined through application of three types of control mechanisms: 1) implementation control initiated principally to review and evaluate the planning process; 2) premise control used to determine systematically whether the premises used in the planning process continue to be valid; and 3) strategic surveillance designed to monitor the full range of events, inside and outside the organization, that are likely to threaten its strategy (Gray and Smeltzer, 1989:206-207).

Through implementation control, management can assess whether strategic plans are progressing as intended. If not, modifications can be made accordingly. Premise control

and strategic surveillance permit identification of significant premise changes or major environmental discontinuities. Continuous or periodic monitoring puts the organization in a position to adjust its strategy before a situation becomes critical. (Gray and Smeltzer, 1989:207).

Implementation Control Assessment. Has PTM evolved as a viable, universally standardized maintenance production concept for all KC-135 units as planned? PTM was initially conceptualized to promote more efficient employment of maintenance personnel to enhance strategic airlift aircraft throughput for home station and deployment requirements. Over time, it has been universally applied, in theory, to multiple airlift and tanker weapon systems. Discussions with maintenance managers and direct observations indicate PTM has not evolved as a standardized operations management concept within or between any of the air mobility weapon systems. The variations on a theme in the field are evidence that units continue to struggle with full implementation of PTM as defined.

Management of flight resources differs from flight to flight on any given base as well as between bases. Although there are "cats and dogs" base idiosyncrasies that prompt creative management actions (imbalances of skill levels, specialist manpower, deployment and training requirements, overhead program manpower requests, and others), the non-standardization cannot be attributed solely to isolated unique situations. There are notable exceptions of airlift bases not yet structured under the objective wing with backshop avionics and equipment maintenance. A second aberration in the airlift community, is the Air Mobility Operations Group supporting the AMC worldwide enroute structure. Both McGuire and Travis Air Force Base organizations were

restructured as of 1 April 1997 to requirements-driven, cross-functional (maintenance, communications, aerial port and other specialties) squadrons within a group to better provide worldwide rapid response capabilities.

One significant improvement since 1993, a response to one of the findings in the maintenance assessments, is the funding of Unit Manpower Document (UMD) PTM positions as well as assignment of personnel to the authorizations. In some cases, bases are manned above their peacetime requirements and filling some wartime authorizations. However, if the manpower is now available and units are not in compliance, this indicates other factors are inhibiting full implementation.

Another discontinuity acknowledged in 1993 has also dissipated over time. Flight organizational wiring diagrams more accurately reflect their daily business operations. The pretense to force-fit PTM has been overcome by structuring operations to meet the tasking requirements rather than artificially superimposing the production concept (flight wiring diagrams not mirroring flight line operations). This does not occur as blatant disregard of official guidance, but instead is driven by the responsibility to continue to customize, tailor and pare resources, to successfully achieve higher headquarters' mission goals and objectives. These missions are not PTM-sensitive--the required production support fragments or "slices" PTM teams which operate as entities at home station. Therefore, the teams are not kept intact. ITUDs and tanker task forces are diversified, varying from two to twelve aircraft, some of which can be double-tasked. A full PTM team complement may not be required for any given tasking. Per the 21 AF/CC, "Our units are making the current structure work, but there are definite shortcomings" (Moffit,

1994). Although the 21 AF/CC may have been suggesting units were trying to force-fit PTM, current observations indicate that may be questionable. Instead, it appears they may be developing, albeit hit or miss, a production methodology or flexible positioning strategy, that postures them to achieve dissimilar higher headquarters' taskings more effectively.

There are more fundamental systemic factors contributing to PTM not yet becoming "fully operational," as planned, since 1993. In total, eight years have transpired with many significant and discontinuous organizational changes ongoing. On 1 April 1997, AMC regained command and control of C-130 CONUS-based tactical airlift. The uncertain post-Cold War security environment and intra-service adjustments, like assimilating another weapon system into the command, have kept the operating tempo high with no extended period of stability to "shake the bugs out" of developing and maturing policies and procedures. One situation after another rolls over each other, inhibiting stabilization or maturation of concepts. It appears that the command-directed operations management positioning strategy continues to be a fluid concept, in part at least, a reflection of the uncertainties of the times and consequential unfamiliar, non-routine mission requirements which continue to shape unit-level maintenance production positioning strategies.

Premise Control Assessment. Are the premises used in the planning process still valid? Many original premises and assumptions dating back to 1989 just prior to the fall of the Berlin wall have been overcome by events. Today, PTM needs to accommodate strategic airlift as well as tankers and tactical airlift, large scale war and peacetime

contingencies, and newly developed personnel policies. While some of these changes have been recognized, modifications to PTM have not necessarily followed suit. In the aftermath of the 1993 Travis Air Force Base C-141 ground mishap, what strategic control advocates would consider the advent of a critical situation in the strategic control process, the intended organizational structure of PTM was clarified not modified. For example, mixed teams of specialists would be assigned to groups of aircraft not individual aircraft (Moffit, 1994). What seems to have occurred were assumptions that PTM had not succeeded because: a) instructional guidance was sparse, confusing units on how to implement PTM; and b) associated UMD positions had not been forthcoming and therefore, the absence of human resources prohibited units from implementing PTM. The lack of both clearly stated policy and procedure as well as the lack of enough resources to implement such policy and procedure, would have reasonably led to the need to clarify PTM as it was supposed to have been structured, followed by fulfillment of the necessary manpower authorizations.

While there may have been validity to these assumptions, in hindsight, it appears that the changing planning premises may have had greater impact on the evolution of PTM than was realized at the time. First, let's examine how the assimilation of multiple weapon systems in addition to strategic airlift impact operations management in the field. In less than ten years, AMC operations changed considerably. PTM was conceived in MAC for strategic airlift weapon systems. Since then, AMC's span of control has enlarged with tanker and tactical airlift weapon systems joining MAC's successor command. With the addition of each new system, PTM was universally applied without

modifications to the concept. Our corporate strategy evolved from one of force projection (strategic airlift) to one that also included force extension (air refueling), while our maintenance positioning strategy remained unchanged. In this particular case, the changes PTM did not accommodate were a couple of key operational concepts integral to tanker, not airlift, operations. One of these operational concepts is the super tanker wings (48 to 60 PAA) which are comprised of multiple flying squadrons with twelve aligned KC-135 aircraft each. Maintenance personnel are also aligned (not assigned) to a particular flying squadron. The day-to-day resource pool for tanker PTM teams is decentralized and reduced to smaller flight organizations. This is not to say that flight line maintenance commanders cannot interchange personnel between flights; however, flight-level team decentralization complicates personnel reassignments. Moving a specialist means shifting from one PTM team to another PTM team within a squadron, but it also entails moving from one flight to another flight, each aligned with different flying squadrons. This may seem to be a trivial management action, but if treated as such, it denigrates the original intent of PTM and flying squadron alignment--both have team integrity (train at home with those you will fight with abroad) as their goal. Moves between flights also counter one of the five implicit assumptions wherein a "reasonable" degree of "membership" and longevity stabilizes both production and health of force activities in an already unstable, back-to-back mobility work environment.

The other tanker-specific operational concept that was not accommodated is the contingency-based ITUD, and the closely related but not contingency-based, tanker task

force. Both are blind to PTM, although both are founded on analogous team integrity objectives. Hereafter, ITUD discussion also encompasses the tanker task force structure.

Unit integrity will be maintained during tanker deployments to the maximum extent possible. This includes not only aircraft from the same unit but command, operations, maintenance, logistics, security, contracting, etceteras. ITUDs capture the synergistic benefits of allowing units who train together at home to operate together when deployed. It also allows unit commanders to provide continuity of command to deployed forces (HQ AMC/DOO, 1995).

The command operations community's ITUD management tool was implemented at a time (1993) when maintenance was assigned to operations, not logistics. When maintenance was reassigned to logistics, a different organizational premise, PTM again remained unchanged. The ITUD cares only that a particular squadron deploys with its own aircraft and personnel. PTM superimposes a more detailed team definition by name, by group of aircraft, by element and therefore, by shift within an element. With maintenance reassigned to logistics, deploying with a flying squadron's own maintenance personnel took on a different meaning. The flying squadron's maintenance personnel were those aligned with them by maintenance flight within an aircraft generation squadron. In some locations, this flight alignment was clearly delineated by color-coding flights and their twelve assigned aircrafts' tail flashes. The ITUD was not integrated in the LCOM although tanker maintenance units comply with ITUD team requirements. Again, although planning premises changed dramatically with the introduction of the ITUD, it appears PTM remained unchanged. It could be that PTM was considered a more stringent subset of the ITUD team requirements and therefore, did not deter from ITUD objectives. If so, by default, PTM integrity became secondary to ITUD integrity.

Second, on paper our command corporate strategy accommodates large scale war and peacetime contingencies. However, our forces are not structured for the day-to-day peacetime contingency operations which creates obstacles to implementing PTM. Top-to-bottom, from DoD to AMC, defense strategies posture military forces for large scale war. Although not a bipolar confrontation of superpowers, the prospect of war is that of two nearly simultaneous MRCs in which forces would be concentrated in one location and then "swing" to another site. Meanwhile, for nearly a decade, troops have postured themselves in conjunction with command-generated deployment packages, for back-to-back MOOTW. This anomaly represents our steadfast orientation to size our forces and to organize, train, and equip them for large-scale war, rendering MOOTWs as marginal, "lesser included cases" (Builder and Karasik, 1995:13). This long-term, secondary emphasis of the business of the day, MOOTWs, has pressured units to adapt their operational strategies accordingly to achieve unfamiliar and uncertain peacetime engagement requirements with adherence to PTM integrity a secondary consideration. In fact, command agencies develop a menu of Unit Type Codes (UTCs) supporting operational plan requirements which consist of deployable maintenance packages supporting up to twelve aircraft in varying locations. Some of these UTCs support MRC-generated requirements. However, these UTCs are also PTM-blind. They are not built to conform with PTM team requirements. Once UTC requirements are fulfilled, personnel at home station will again be organized to realize economies of scale as with the ITUD operational concept discussed earlier. Maintaining this large-scale, regional war level of combat readiness also presents a formidable dilemma in an era of declining defense

budgets projected until at least 2010 and a simultaneous, increasing trend for peacetime engagement missions not necessarily requiring combat-related skills. Congressional leadership expects the DoD to develop more frugal military options, thus the advent of the AEF and on-going research for a better mix of active duty, reserve, and guard units. The familiar full-scale war doctrine prepares troops to be combat ready for a probability, but the more unfamiliar peacetime engagement contingencies are the actual operational demands faced daily.

Third, PTM was developed prior to command management policies like the 120-day personnel deployment standard. This new premise, external to the development of both PTM and the ITUD, overlaid another planning factor for units. The standard is currently strongly enforced through monitoring and command reporting requirements. It places emphasis on equitable distribution of the TDY workload, forcing a mandatory although temporal, modification on the PTM concept of operations.

Strategic Surveillance Control Assessment. Have the major events likely to threaten PTM integrity, inside and outside of the maintenance organization, been monitored? While premise control assessment evaluates the validity of planning premises, strategic surveillance control is the mechanism organizations use to monitor changes likely to impact their operations and possibly change planning premises. To date, six major internal organizational restructuring efforts (Figure 2, Chapter 2) and the implementation of three significant management tools and policies (LCOM, ITUD, and the 120-day personnel deployment standard) creating substantial discontinuity within the maintenance community have not gone unnoticed. Some of these organizational changes were in

direct response to external public policy decisions to downsize the Cold War military forces and to realize the peace dividend from a diminished bipolar superpower threat. Command logistics senior management and staff personnel have tediously developed master strategic plans with corresponding roadmaps and action plans for short-, medium-, and long-range time periods that are recycled annually (HQ AMC/XP, 1996 and Moffit, 1996).

While critical strategic surveillance monitoring mechanisms like the AMC AMMP and Logistics Strategic Plan have been established, it appears that supporting functional area positioning strategies, like PTM, may not be fully integrated into the operations management planning framework. Full integration would permit functional managers the opportunity to assess whether or not the positioning strategy postures maintenance accordingly to support the AMMP-declared AMC operational tasks: air refueling, cargo airlift, passenger airlift, airdrop, aeromedical evacuation, special operations, and the Single Integrated Operations Plan. Historically, it appears PTM has run a parallel course to events with no apparent modifications to accommodate the assimilation of new weapon systems, operational concepts, organizational structures, or personnel management policies. It may be modifications to the PTM positioning strategy were considered unnecessary.

As indicated by this strategic control assessment of PTM, it appears that the PTM positioning strategy can benefit from re-evaluation. The following "nuts and bolts" operational-level assessment, through application of the Theory of Constraints

methodology, provides more in-depth insight to specific constraints (bottlenecks) that also suggest the need for re-evaluation and modification of PTM.

Operational Assessment of PTM

Theory of Constraints Methodology. The application of a set of concepts known as the Theory of Constraints (TOC) enables a more in-depth, operational-level analysis of PTM. TOC assumes that the flow through any system is limited by constraints, or bottlenecks. This flow can be the flow of a new concept, like PTM, through a design and development process (Simons and Moore, 1992:1). More importantly, the TOC approach recognizes that a balanced flow is determined by system constraints, and that only with proper management, can limitations be minimized to ensure achievement of the overall goal of the organization (Goldratt, 1990:4-8). In this case, the goal is full implementation of PTM as a viable KC-135 tanker production maintenance concept.

TOC purports that proper management of identified constraints through exploitation, subordination, and elevation techniques can improve the flow of any process. Exploitation advocates maximizing 100 percent utilization of a constraint within an operating system (not all operations within a system). The constraint should be working the right jobs and non-essential activities should be off-loaded to move the system closer to the overall (production) goal. For example, military executive officers off-load tasks from the constrained resource of general officers. Subordination simply means all elements within a system support the constraining resource. Active subordination refers to using non-constraints to facilitate the constraint. An overage of one AFSC may be able to cover for the shortage of another AFSC if personnel are cross-trained. Passive

subordination is a premeditated effort to not do things that contribute to system throughput. And finally, elevation is the process of lessening the severity of a constraint and increasing the flow through it. Hiring another employee, purchasing more equipment, or revising or eliminating a policy are all possibilities. The caution is not to immediately jump to the elevation technique as a possible remedy, but to attempt to achieve improvements through exploitation and subordination first (Simons and Moore, 1992:4-6).

In the commercial sector, if there is constraint (a bottleneck) in production, it is likely to unacceptably reduce profit potential. In contrast, the question arises that if there is a bottleneck in implementing PTM, how does it impact its viability as a maintenance production positioning strategy? Are the constraints physical or procedural in nature? Are they internally or externally imposed constraints? The "profit potential" at risk in this case is securing our capability to be responsive, reliable, flexible, and precise with fully adaptive, versatile, and mobile forces projectable from anywhere in the world within hours or days (Shalikashvili, 1996:24). Answers to these questions assist in determining the factors that adversely impact PTM implementation, its viability, and its "fit" in today's national security environment.

Researchers do caution that identification of a (operational level) constraint is a strategic decision and "must be based on the fact that it limits the system's ability to achieve its (overall) goal" (Simons and Moore, 1992:6). Strategic decisions are complex and a solution to one problem on one weapon system may elicit a unique problem on a different weapon system. One size, one production concept or one positioning strategy,

may not “fit” all weapon systems. The following analyses lend insight to the specific constraints prohibiting full implementation of PTM in the KC-135 community.

Physical Constraints Assessment. Physical constraints can be internally or externally imposed. They, too, can limit the full implementation of PTM as a viable production concept. Equipment and people resources are examples of this type of potential bottleneck (Simons and Moore, 1992: 4). Physical constraints pertinent to PTM include the LCOM simulator, labor, and aircraft requirements and assignments/alignments.

LCOM Simulator. There are several significant LCOM modeling simulator constraints. Computer models relating support resources to wartime tactical weapon system availability represent the dominant theme in this research modeling field. Even so, the Air Force’s LCOM, a Monte Carlo simulation model, captures most of the resources required to generate aircraft sorties to include organizational and intermediate levels of maintenance (Gotz and Stanton, 1986:1). Detailed rules listed in Chapter 2 are given for how maintenance tasks are to be accomplished. However, RAND PROJECT AIR FORCE researchers have identified several significant constraints in the simulator that contribute to the development of a less realistic notional model.

- Personnel performing maintenance tasks are not described in detail in terms of output and, therefore, not adequately considered (Rich, Cohen, and Pyles, 1987:9).
- Uncertainties in the demands for resources in peacetime and war have not been appropriately accounted for and are directly affected by adequate personnel accountability (Cohen, Abell, and Lippiatt, 1991:v)
- Use of a single wartime scenario for the simulator.

- Assessment of readiness and sustainability has focused on wartime scenarios rather than peacetime readiness for war and what is referred to today as peacetime engagement of military operations other than war (Builder and Karasik, 1995:1-3).

The first notable simulator constraint is that manpower has historically been modeled as having one skill level for each occupation. Substitution of personnel from different specialties was either absent or assumed to be a perfect match. When defined as a perfect match, a cross-trainee who does not regularly perform a task is assumed to accomplish those tasks as fast as those primarily trained for the tasks (Cohen, Abell, and Lippiatt, 1991:2).

RAND researchers adapted their Dyna-Sim model with the addition of a "personnel with different skills" dimension. Priority-of-repair rules were also expanded to not only account for the number of parts needing repair, but for "who was free to work a repair" (Gotz and Stanton, 1986:3). The overall emphasis of the revised model is skill mixes of intermediate level repair maintenance personnel in a dynamic environment. The manpower mixes utilized in modeling wartime weapon system availability were (Cohen, Abell, and Lippiatt, 1991:2):

- one skill level per occupation and no cross-trained personnel.
- cross-trainees at a lower skill level in another occupation.
- second skill level per occupation while retaining cross-training for personnel who have a high skill level in their primary occupation.

Simulation results highlighted the feasibility and utility of modeling unit outputs under alternative mixes of maintenance manpower. Most significant was the direct implication that models such as the LCOM could under-predict performance of units and, therefore,

over-estimate manning requirements. Models whose job assignment rules assign "free" repairmen the jobs they do best are virtually the same as the no substitution job assignment rules because they do not take advantage of the flexibility afforded by cross-training. (Gotz and Stanton, 1986:32).

The second shortfall is the inattention to uncertainties in demand in both peacetime and war. Weapon system availability is totally dependent on the balance of available resources. Uncertainty places a premium on flexible assets. Because people can be more flexible than hardware (spare parts), inattention to uncertainty probably means our more flexible people resource is being undervalued relative to other assets (Gotz and Stanton, 1986:33).

Finally, in *Coupling Logistics to Operations to Meet Uncertainty and the Threat (CLOUT)*, a product of the RAND "Uncertainty Project," the authors address the third and fourth constraints inherent into the LCOM.

...the very use of a single wartime planning scenario implicitly denies that we have great uncertainty about such important factors as the level of activity; the impact of these activities on the demands for resources; force beddown mix; damage to spares, repair, and personnel resources in base attacks; the system disruptions that seem almost inevitable in wartime; and all of the other surprises the is likely to induce. (Cohen, Abell, and Lippiatt, 1991:vi)

The researchers focus their energies on a more responsive in-theater logistics system that can cope better with short horizon, unanticipated events. They equate quicker response capability to less vulnerability to uncertainty--more robust performance in state-of-the-world uncertainty (not repeatable and/or not observed as compared with repeatable and observable statistical uncertainty). This is the uncertain world military leaders must

address. CLOUT encourages managers to rely less on the ampleness or richness of goods (spare parts) and more on management adaptations to achieve relevant, timely, and robust performance needed to cope with unanticipated, uncertain, and urgent demands for resources. Even in peacetime, "buyout strategies" are not likely to be economical especially in a constrained funding environment. There is not an infinite supply of parts or people (Cohen, Abell, and Lippiatt, 1991:vii).

The CLOUT model scenario was familiarly founded on a high-intensity conventional Cold War conflict between NATO and Warsaw Pact forces with considerable inherent variation. Whereas the European conflict provided a prescribed scenario for military planners, the Air Force now faces an uncertain range of peacetime engagement MOOTW-type scenarios with some degree of corresponding variation unique to each. Regardless, principle assumptions of CLOUT have been confirmed: predictions are hazardous, adaptations are extremely important, and quick response is what forces in the field expect (Cohen, Abell, and Lippiatt, 1991:xi).

The most important central message is to take as full account of state-of-the-world uncertainty as possible by formulating policies and designing logistics systems whose performance is robust in the face of those uncertainties in both peacetime and wartime (Cohen, Abell, and Lippiatt, 1991:xii).

PTM was not an integral assumption of the LCOM simulation. Through application of a PTM variance, additional manpower requirements supporting the PTM concept were generated above and beyond those the LCOM simulated as necessary for the two nearly simultaneous, MRC-premised scenario--the worse case scenario.

The LCOM-simulated requirement (47 peacetime and 50 wartime), while providing adequate shift coverage to meet the mission, does not always provide 24-hour/day coverage for each AFSC, nor does it directly address training requirements or skill-level distributions to meet those training requirements. When this occurs, the PTM Variance is used to ensure appropriate coverage to meet mission requirements. (HQ AMC/MEF/XPMEM, 1995:5)

To implement PTM for elements of six aircraft, AMC functional managers developed the team size considering 24-hour/day AFSC coverage, training requirements, and skill level distributions. The resulting complement was 54 peacetime spaces and 58 wartime spaces. The KC-135 LCOM recommended these manpower allocations.

Labor Force. Decentralization of PTM to the element level, requiring two teams per flight, detrimentally dispersed scarce personnel resources. The LCOM PTM complement, through application of the PTM variance, provides an exact number of personnel for each of two elements of six aircraft in each flight. With 54 peacetime spaces (58 in wartime), there are nine maintainers earned per aircraft in each PTM team. Four are (strategic) aircraft crew chiefs (does not include Support Flight crew chief authorizations) and one each pneudraulics, electro-environmental, propulsion, communications and navigation, and guidance and control specialists. Hence, for a flight of 12 aircraft, there are 48 crew chiefs and 12 specialists for each of the other five specialties. To determine rank structure (not skill levels), the LCOM grade table is overlaid for a crew chief workcenter of 48 and each of the other five specialist workcenters of 12 each. Skill level distribution can be roughly estimated by applying the HQ AMC/LGQ 75 percent trained (in-training)/experienced goal against the authorized structure.

Table 2 best illustrates flight PTM team composition in a squadron of 48 PAA with four flights of 12 PAA. Column 1 lists the enlisted grades considered for each workcenter in the LCOM. Columns 2 and 3 give the total numbers of crew chiefs and all other flight line specialists assigned to an aircraft generation squadron with 48 PAA. Columns 4 and 6 represent one of four flights' crew chief and specialist authorizations, each of which would be theoretically identical in the squadron. Columns 5 and 7 depict the application of the 75 percent trained(in-training)/experienced training objective to the flight-level crew chief workcenter and one of the specialist workcenters, respectively. Each of the five specialist workcenters, other than crew chiefs, would mirror the Column 6 and 7 examples in the chart.

Table 2. Flight Peacetime LCOM Grade Table and HQ AMC/LGQ Training Objective Application for AGS of 48 PAA.

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
Grade	Peacetime UMD: Crew Chiefs Per Squadron	Peacetime UMD: *Other Flight Line Specialists Per Squadron	Peacetime UMD: Crew Chiefs Per Flight (Column 1 Total/4)	Application of the 75% Trained/In-Training/ Experienced Objective	Peacetime UMD: **Other Flight Line Specialists Per Flight (Column 2 Total/5/4)	Application of the 75% Trained/In-Training/ Experienced Objective
Master Sergeant			2	1 (9-Level)	1	1 (7- or 9-Level)
Technical Sergeant			5	3 (7-Level Craftsmen)	2	1 (7-Level Craftsmen)
Staff Sergeant			12	9 (7-Level Craftsmen)	3	2 (7-Level Craftsmen)
Senior Airman			17	12 (5-Level Journeymen)	3	2 (5-Level Journeymen)
Airman First Class			12	12 (3-Level Apprentices)	3	3 (3-Level Apprentices)
Total	192	240	48		12	

(HQ AMC/MEF/XPMEM, 1995 and HQ AMC/XP, 1996: 3-20)

*Other flight line specialists include pneudraulics, electro-environmental, propulsion, communications and navigation, and guidance and control.

**Each of the five specialties listed above would mirror this distribution.

All airman first class were considered in training and 75 percent of the senior airmen through master sergeant were considered trained/ experienced (not in-training).

Understanding there are numerous “what ifs” that could be applied, the intent was to illustrate a realistic snapshot, if not idealistic, of the typical flight-level PTM manpower distribution by grade and skill level. An example of one of countless “what ifs” would be that if a technical sergeant specialist is not a seven-level, chances are the specialist is a five-level and could be counted (but is not) as such in this chart.

What is of concern follows. Although consideration was given by functional managers to account for 24-hour/day AFSC coverage, training requirements, and skill level distributions for a six PAA PTM team, the two team per flight structure detrimentally decentralizes trained and experienced journeymen (five-levels) and craftsmen (seven-levels) personnel. In fact, Column 5 (crew chiefs) and Column 7 (other specialists) personnel must be split in half to constitute two self-sufficient, by name, by six PAA PTM teams. At first glance, this does not allow seven-level coverage across all specialties except crew chiefs on all (eight-hour peacetime) shifts (24-hour coverage) for each PTM team. While this chart considers the 75 percent trained (in-training)/experienced objective, it does not address leaves, absences for training, the annual 120-day deployed personnel policy, and the further fragmentation or “slicing” of PTM teams for deployments. If, for instance, four of six PTM team’s aircraft deploy, how is adequate coverage deployed while maintaining the same for the two aircraft at home base assuming the goal is to maintain PTM team integrity at home and abroad? Not unlike the Army dilemma of “slicing” a battalion, how do you effectively “slice” a PTM team?

It appears that there is little to no personnel management “wiggle room” for maintenance managers attempting to “make” PTM work. They are presented with a

highly sensitive and volatile scheduling problem due to no excess personnel capacity. With no capacity cushion, an event as common as a deployment, leave, or critically needed training creates an immediate imbalance in an element-level PTM team, thus prompting the consolidation of personnel resources across PTM teams within a flight to ensure work is accomplished correctly and safely. A great deal of effort must be expended to try to maintain PTM as a viable operations management production concept. It is a constant battle of overcoming personnel imbalances prompted by known (leaves and training) and uncertain (deployments) events.

Aircraft Assignment/Alignment. Because taskings can require up to 12 aircraft, PTM team integrity cannot always be kept intact. The 12 aircraft aligned to each tanker operations squadron and their aligned maintenance flight does not accommodate all ITUD and tanker task force taskings for a couple of reasons. First, since 1989 the peacetime engagement contingency operations tempo has been high and it is not predicted to subside in the near future. When PTM was introduced and later super tanker wings were activated, leadership did not have visibility of the frequency and size of the deployments. Today, we have much experience accumulated. We know that taskings range from 2 to 12 aircraft with as many as 100 maintainers supporting overseas missions for up to 90 days.

Second, to manage the health of the tanker wing's fleet, the wing-wide aircraft inspection flow is developed to ensure inspections are conducted as close to the due date as possible, ensuring a smooth, continuous flow and capitalizing on the significant cost of these inspections. This inspection scheduling process is PTM-blind, placing a flight's

aircraft in the inspection docks at home or at the depot as close as possible to when the inspection comes due. When a maintenance flight is tasked for a large deployment, they could be short a couple of assigned aircraft. The fleet inspection program with its goal of health of the wing fleet takes precedence over maintaining the integrity of PTM and ITUD concepts.

Aircraft availability within a wing is not the constraint. Instead, the constraint to PTM is the underlying assumption that PTM teams are assigned to six to eight of a flight's assigned aircraft. This is magnified by the ITUD concept of operations which also seeks to fly with the flying squadron's tails whenever possible. This "aircraft restriction" becomes more pronounced when flying squadrons and flights personalize their tail flashes with differing color schemes. It deepens the commitment to fly with one's own aircraft, beyond the more common assignment of aircraft by tail number only. PTM teams necessarily become redefined by assigning maintainers to another flight's aircraft or deploying another flight's maintainers with their assigned aircraft.

Hence, contrary to the fifth implied PTM assumption, the wing inspection schedule initially drives which aircraft will deploy. Compliance with the ITUD concept and the supporting UTCs takes priority over PTM.

Procedural Constraints Assessment. A second type of constraint is the procedural constraint which may be a policy, an operating instruction, technical data or other written guidance. It, too, like a physical constraint, can be externally or internally imposed. Nonetheless, it limits the system's ability to achieve its goal, and in this case, that equates to full implementation of PTM as a viable production concept (Simons and Moore, 1992:

4). Relevant procedural constraints include PTM instructional guidance, the ITUD operations deployment concept, and the 120-day personnel deployment standard policy. As discussed previously, these latter two command management tools were developed in isolation of PTM. Each were PTM-blind in different ways, understanding that PTM notionally assumes self-sufficient, element-level team integrity through by name, by group of aircraft assignments across shifts at home and abroad.

PTM Instructional Guidance. What is subtly not included in the definition of PTM (reference Chapter 1) may indicate the roots of labor force assignment and utilization constraints contributing to continued non-standardization of PTM in the field. For example, "PTM *integrates multiple AFSCs* into teams that generate, launch, and recover aircraft" and "In AMC, these teams will be identified down to the SGF level and *consist of mixed APG/specialist personnel*" (HQ AMC/LGQP, 1995:30-31). A third related reference is "PTM *integrates aircraft maintenance AFSCs* into teams that generate aircraft" (HQ AMC, 1995). It is significant to note that what is not said in any of these references is that *all* sortie generation AFSCs will be represented on these teams. Skill level and experience level expectations for the teams are also absent, leaving it to the discretion of management to configure their teams with a range of mixes (some or all), of the AFSCs.

The emphasis on *mixed AFSCs* with no reference to training and experience levels also begs the question of whether PTM team self-sufficiency can be realized at this point in time. If self-sufficiency can be realized, current peacetime UMD authorizations and manpower grade distribution tables (e.g., twelve total apprentices, journeymen, and

craftsmen hydraulics specialists per flight, six per element) suggest, at best, this would be at the element level. It is dubious that self-sufficiency could be operationally achieved at the shift level within each element due to the diseconomies of fragmenting an already limited specialist resource pool across two elements. It is highly unlikely there would be seven-level craftsmen supervisors available to be assigned on each shift. Of twelve authorized specialist positions, six are targeted for seven-level craftsmen (one master sergeant, one technical sergeant, and three staff sergeants). It takes staff-sergeant selects a minimum of 18 months to meet experience requirements, certification of required seven-level tasks, and up to a year to complete a required, non-task-oriented two-week school due to a system backlog. Today's training requirements result in up to a two-and-a-half year upgrade training process.

While the current PTM definition gives management necessary latitude to assign their resources, it also spawns diverse team configurations in elements, and therefore across shifts within each element. The PTM policy as written may reflect senior leadership's recognition that Unit Manpower Documents (UMDs) were not yet standardized and manpower conversions supporting the PTM concept were still evolving since the 1993 assessments (Fromm, 1993). The first KC-135 LCOM which standardized UMDs by the number of primary aircraft assigned was forwarded to Air Staff for review in May 1995.

Manpower conversion within PTM will become formalized and will accelerate. Of necessity, due to the large APG task loads on AMC flight lines, PTM was implemented with an emphasis on APG AFSCs augmented by small numbers of specialists. As we mature the system, deliberate conversion of manpower authorizations will occur to more heavily balance the workforce to a specialist-oriented (with the APG career field being one of several specialties), CUT-trained structure.

We will work with wing LGs to standardize the UMDs to reflect standard work center authorized manning levels. As we made the massive transition of the past several years, we left manning levels within and between work centers largely to the discretion of local managers. As expected, significant differences emerged, with some wings maintaining formidable structures in backshop work centers (and consequently operating with fewer available manpower resources on the flight lines) while other wings leaned in precisely the opposite direction. By this time in our evolution, we have corporately developed a pretty good feel, based on observing wing performance and their progress in implementing PTM, for how low we can drive backshop manning in order to augment flight line availability, all while preserving effective intermediate maintenance capability. (Fromm, 1993)

While reference is made in paragraph 3.15 to detailed organizational structures in a previous chapter's figures, there is no explicit narrative reference to the SGF-level teams being comprised of 6-8 *aircraft elements* (referred to as *sections* in the 15 June AMC instruction figures) within a flight. Specific narrative reference to elements was made in the 22 April 1994 publication of the instruction: "In AMC, these teams on the flight line will be identified down to the sortie generation flight level, and consist of *mixed specialist and APG elements*."

Realizing there was confusion in the field with implementing PTM after the 1993 C-141 ground mishap, clarifying the PTM structure in policy was a priority for the HQ AMC/LG. It appears, however, that there may be underlying manpower-related bottlenecks driving a less-than-clear definition of the PTM structure and contributing to the continued plethora of non-standardized PTM team configurations in the KC-135 community. More significantly, journeymen on some shifts are not supervised by specialist craftsmen.

ITUD Operations Deployment Concept. The varying ITUD mission resource requirements, supporting up to 12 aircraft, do not necessarily permit maintaining PTM team integrity at home and deployed locations simultaneously. AMC currently supports five long-term, rotational ITUDs/tanker task forces--Operation SOUTHERN WATCH, Operation NORTHERN WATCH, Operation JOINT GUARD, European Tanker Task Force, and the Howard Tanker Task Force. Resource requirements for these taskings, some nearly seven years in duration, must be filled and are structured for worse case scenarios which drive manpower requirements. As mentioned earlier, ITUDs are PTM-blind and sustaining assigned PTM teams is less a priority than deploying the "right" maintainers for each worldwide tasking. "Right" could be necessary rank structure for overall supervision, required skill level distribution to ensure around-the-clock deployed maintenance capability, or even the flying squadron commander's or sortie generation flight commander's preference.

From an operation's perspective, personnel resources are managed as flight-level assets, not element-level (six to eight aircraft group) assets expected to remain intact at home and abroad in PTM's purest sense. As ITUDs are currently defined, the operations community expects maintainers to first be sourced from their aligned maintenance flight. If the selected flight maintenance team happens to mirror the element PTM teams, it's a coincidental event.

Although ITUDs are short-term, 90-day deployments by design, partial-PTM teams at home (those team members left behind) are commonly consolidated with the second home-based PTM team within the flight. This consolidation is usually driven by either no

or too few assigned aircraft remaining behind at home station for the partial-PTM team to support or an inadequate mix of maintenance specialists. Not only is there consolidation of PTM teams within flights, but there has been occasion to assign home-based personnel to augment another maintenance flight. Economies of scale are realized based on a management call that consolidated capacity is needed to meet home station demands.

What the ITUD is not blind to is tail flashes. Aircraft assignment varies in the KC-135 community with some wings identified by a singular tail flash color scheme and others identifying different squadrons within their wings with different tail flash schemes. In the latter case, the expectation of both operations squadrons and their aligned maintenance flights is that they will deploy with their own flight-assigned aircraft whenever possible.

120-Day Personnel Deployment Policy. Should a PTM team member meet or exceed this standard, maintenance personnel not necessarily assigned to the same team would have to be deployed. The standard takes precedence over PTM team integrity. Although commanders desire more authority to use their discretion to select individuals to deploy on specific operations or in excess of the 120-day standard, it is currently being strictly enforced and monitored through Air Force reporting requirements (HQ AMC/DO, 1997).

It might be assumed that before the 120-day policy, maintenance personnel were selected with PTM team integrity the prime driver. Even then, however, units commonly selected volunteers and those they considered most capable for particular missions without regard to PTM team assignment. This policy was not included in LCOM peacetime simulations.

Training Policy. HQ AMC/LGQ is pursuing numerous initiatives like base-level interactive courseware “to reverse a declining trend in maintenance experience and to expedite a trainee’s qualification process” (HQ AMC/XP, 1996:3-20). Their objective to “maximize logistics training resources to maintain 75% trained (in-training)/experienced level workforce for each weapon system and specialty code” is probably realistic given the command-wide backlog in training (e.g., the required two-week seven-level school) and the concomitantly high operations and personnel tempos. However, as will be demonstrated in a later discussion of labor force constraints, a 75 percent goal of trained (5- and 7-levels) and/or personnel in training (3-, 5-, and 7-levels) just meets or falls short of minimum labor levels needed to implement PTM as currently defined. Peacetime UMD authorizations for each of the flight line AFSCs except crew chiefs is an aggregate (3-, 5-, and 7-levels) total of 12 per flight. There is an aggregate of 48 crew chiefs per flight, four per aircraft. Applying the 75 percent goal of trained or in-training leaves each flight with a total of four seven- and nine-levels, assuming they are trained and not in training, to distribute across two 24-hour coverage, element-level PTM teams. When deployments, leaves, and absence for training are considered, the number of available trained and experienced specialists shrinks to only one or two per flight at home station and a deployed location. In effect, the 75 percent objective represents a cascading skill level downgrade of UMD-authorized grade levels. For example, if three staff sergeants are authorized, application of the 75 percent objective suggests two will be trained or in-training. Table 2 portrays the impact of the training objective on workcenters.

Overlaying Year of Training initiatives on the HQ AMC/LGQ's training objective further magnifies the constraining effects of current training and experience requirements on both the available training resources (instructors) and the availability of trained and experienced personnel. Furthermore, if AFSC restructuring continues as speculated, the integration and elimination of AFSCs will continue to squeeze personnel out of the military, making it progressively more difficult to support two PTM teams per flight (Fromm, 1993). While we may cross-utilize personnel more and more across specialties, it will simultaneously become more difficult to decentralize fewer and fewer resources.

PTM is faced with constraints like any other all-encompassing concept might be. The favorable resolution of these constraints is desirable. Chapter 4, Recommendations and Conclusions, suggests possible alternatives to overcome identified constraints and improve the viability of PTM.

IV. Recommendations and Conclusions

Introduction

The recommendations in this chapter are offered to enhance the viability of PTM in the KC-135 tanker community. Due to the strategic, procedural, and physical constraints discussed in Chapter 3, PTM has not been fully implemented as planned, nearly four years after the C-141 ground mishap. PTM is still not standardized within the KC-135 tanker community or within airlift organizations. It competes with other agencies' operational concepts (ITUD) and policies and procedures (120-day deployed personnel standard) external to command functional manager purview. However, by definition, it also constrains itself with a decentralized, horizontal organizational structure fraught with long-term manpower challenges (force reductions and trained/experienced personnel). Back-to-back contingency operations (MOOTWs) also contribute to PTM not being fully realized. This continuous subjugation of the concept renders it a paper theory with questionable pertinence to the field, and not likely to survive as currently defined.

Although not presented as a panacea to the constraints adversely impacting the viability of PTM, the following suggestions address the research questions posed in Chapter 1, possibly paving the way to : a) integrate PTM more deliberately into the strategic-level operations management planning framework; b) develop a more practical working definition of PTM, considering its current constraints; and c) offer an organizational structure that can be standardized across AMC KC-135 tanker units improving PTM's "fit" in the field.

As a reminder, the recommendations were formulated through application of the TOC techniques--exploitation, subordination, and elevation--defined in Chapter 3. At the heart of TOC methodology is the assumption that proper management of constraints with these techniques can improve the flow of any given process. Perhaps the development of PTM can be improved within the KC-135 community, positively contributing to the prevention of any future maintenance-related critical incidents. Recommendations are subdivided under strategic control, procedural, and physical constraint sections mirroring the conceptual and historical analyses in Chapter 2 and the constraint analysis in Chapter 3.

Recommendations to Improve Strategic Control Constraints

To ensure functional area managers are afforded the opportunity to re-evaluate the PTM positioning strategy when changes in corporate strategy occur, PTM should be added as a line item in the appropriate supporting logistics action plan to the Logistics Strategic Plan. This would ensure an annual review of the operational level strategy, permitting timely modifications in concert with higher headquarters' changes in strategic direction. This annual review would help reinforce PTM as a strategy-based, and not solely a resource-based, production concept capable of supporting the operational tasks defined in AMC's annual AMMP or the operational concepts, like the ITUD, proposed by other command functional area managers. It also permits assessment of the impact on PTM of personnel policies like the 120-day personnel deployment standard. In addition, entry of a formal action item would provide long-term visibility regardless of frequent changeovers in command leadership. This action would inhibit parallel, discontinuous development of PTM by linking strategic defense theory with organizational practice. It

would better ensure assessment of the functional area positioning strategy is fully integrated into the operations management planning framework.

Recommendations to Improve Physical Constraints

Logistics Composite Model. The LCOM needs to be improved or alternative modeling and simulation technology to the LCOM needs to be exploited to better account for logistics support activities and capabilities. If we agree that secondary skills (CUT and Certified Mechanic and Certified Master Mechanic) contribute to the viability of a unit in a peacetime and wartime environment characterized by uncertain demand, they should then be accounted for in readiness and sustainability measures. Counting the “inventory” of secondary skills to identify doubly and triply covered jobs would improve measures of unit readiness for war (Gotz and Stanton, 1986:33).

Inclusion of multiple skills and uncertain demand factors in simulation models promote the development of much more flexible and robust support systems (Rich, Cohen, and Pyles, 1987:9). It's best not to behave unrealistically, as if demands are certain, and consequently design systems that are optimized to meet those questionable demands. If nothing else, facing as much of the uncertainty as we can and entertaining alternative scenarios reflective of the broad spectrum of peacetime engagement military operations other than war, will at worst better mentally prepare us to more adeptly consider alternate optimal solutions for any given situation (contingency management) with its unique characteristics (Gray and Smeltzer, 1989:65, 240-241 and Cohen, Abell, and Lippiatt, 1991: xii). Management systems that can become part of standard, day-to-day peacetime readiness assessment operating practices will better transfer to the wartime

environment. Stated otherwise, maintenance managers need to clearly understand their role in the interaction among demand uncertainty, maintenance repair bottlenecks, and subsequent creative management adaptations. They also need to comprehend how the sustainment capabilities of their repair shops affect aircraft readiness (Rich, Cohen, and Pyles, 1987:9). "Readiness and sustainability assessment represents more than a means of looking at past decisions. It is now a required and increasingly important element of day-to-day combat force operations, support system management, and planning for future forces and operations" (Rich, Cohen, and Pyles, 1987:2).

Recognizing that force structure planning and programming is heavily reliant on modeling and simulation, the AMMP-97 "Modeling and Simulation (M&S) Roadmap" plans to "selectively improve existing mission and system models" (HQ AMC/XP, 1996). No specific reference is made to LCOM upgrades or alternatives. However, models like the Dyna-SIM and the Dyna-METRIC, for example, were adapted by RAND researchers to account for the addition of uncertain demand and the "personnel with different skills" dimension and their impact on maintenance outputs under alternative mixes of maintenance manpower (Gotz and Stanton, 1986:3 and Rich, Cohen and Pyles, 1987:9). Application of computer models capable of factoring more complex job assignment rules, more skill mixes, and a broader spectrum of scenarios may better posture AMC to compete for dwindling defense resources. Integration of PTM and currently compiled data bases for peacetime contingencies, to include ITUDs and the AFSC statistics for the 120-day deployed personnel policy, into the M&S core decision and forecasting modules may yield a number of different net effects. Without consideration of the previously

mentioned factors, the net effect was a decrease in manpower authorizations. However, it could be that the cumulative effect of pertinent factors would create a net increase in manpower authorizations, even above those generated by the late "incorporation" of PTM into the KC-135 LCOM (HQ AMC/MEF/XPMEM, 1994). With greater model fidelity, AMC leadership could be provided a more consistent and accurate representation of the future force structure and consequently, plan and program force sizing accordingly.

Labor Force and Aircraft Assignment/Alignment. An immediate option would be restructuring PTM teams by consolidating crew chiefs into one element and all other specialists into a second element within a flight supporting 12 assigned aircraft. This would exploit the constrained labor force and enlarge the team's pool of equipment. This labor centralization effort would improve utilization of all specialist skill levels across all shifts by realizing economies of scale. Even after application of the 75 percent trained (in-training)/experienced objective but with very careful scheduling, there are multiple benefits to this consolidation initiative:

- There could be seven-level supervision in all flight line maintenance specialties across all shifts, assuming bases were assigned their full complement of peacetime authorizations.
- The 120-day personnel deployment policy could be better managed within each specialty particularly if flights have long-term visibility of the rotational ITUDs.
- A more robust manpower pool permits more flexibility and therefore, more management options to cover the spectrum of uncertain, short-notice taskings requiring maintenance support for up to 12 aircraft
- With seven-level craftsmen on each shift, three- and five- level qualification and certification upgrade training could be conducted around-the clock.

- Overhead program management within the flight could be better managed. Both the Flying Crew Chief program and reconstitution efforts for SIOP benefit from crew chief centralization and a more simplified scheduling process (not crossing elements).
- The change would be transparent to the operations community. ITUDs would continue to be supported by the same aligned maintenance personnel.

Even though this option would lessen the impact of the labor constraint, it still would require improvement of a very precise and sensitive balance of specialties to ensure representation of all skilled and experienced specialists on all shifts. Legitimate absences of personnel for leave, professional military education, and details would immediately create holes in the noncommissioned officer ranks. Some relief could be experienced by units continuing to exploit the core PTM, cross-utilization training, and Certified Mechanic (CM) and Certified Master Mechanic (CMM) programs. All are initiatives to increase the productive capacity of flights by training the workforce in families of skills, not unlike the commercial airframe/power plant and avionics skill designations.

However, none was intended to be a "blanket" program wherein all personnel were cross-trained. Personnel in CUT were intended to be selected to purposely fill areas needing augmentation and those in the CM/CMM programs were identified as a select cadre of highly motivated and responsible technicians capable of unsupervised work.

Furthermore, this PTM configuration would leave no room for flights to serve as the manpower pool for other maintenance workcenters like the Maintenance Qualification Training Program and the many overhead squadron and flight programs (e.g., computer LAN, mobility, dormitory manager, quality, and self-help). These and other programs would need to be subordinated to the effort of establishing a viable flight PTM team.

And finally, concerted effort would be necessary to prevent specialists from sliding back into the "dispatch" frame of mind. Manpower would remain a premium even with consolidation of resources at the flight level. No unit could afford to cultivate rigid adherence to perceived AFSC task restrictions (union rules). Breaking through prevailing rules of task assignment and promoting general flight line production skills is a PTM guiding principle that should stay intact without denigrating specialists' primary skills.

Also, the likelihood of the flight ever having a full complement of 12 aircraft would be dubious if for other reason than scheduled periodic inspections at home base or the depot. Flights would still have to "borrow" aircraft to fulfill tasking requirements.

Because such a configuration of PTM would be a deviation from command maintenance management policy, it would need to be elevated to command functional managers for waiver approval. The internal consolidation of flight resources would require no cross-functional coordination and no additive manpower authorizations, making the change palatable, uncomplicated, and immediately responsive.

The second restructuring option is an extension of the previous proposal and is a more comprehensive consolidation of maintenance resources. The merging of two maintenance flights into a singular aircraft maintenance unit (AMU) would more responsively address current PTM manpower shortfalls, but it would not be a seamless transition within and between the logistics and operations communities. It also raises the question of whether or not this breadth of expansion stretches the limits of the current definition of PTM teams, therefore invalidating the PTM concept as defined today. Although only subsets of the AMU team would be deployed, this would not differ

operationally from the subsets of the smaller flight teams currently being deployed except that the resource pool has been enlarged.

In addition to all the benefits offered by the within-flight consolidation action, this merger would offer:

- a manpower buffer, some capacity cushion, within all specialties where none existed in the within-flight merger. It would nearly double the manpower listed in Table 2, Chapter 3.
- a more robust manpower pool with more scheduling flexibility and therefore, more AMU management options to support maintenance for up to 24 aircraft (two 12-aircraft UTCs or double-tasked 12-aircraft UTCs) while maintaining the integrity of PTM.
- more manpower for overhead program management requirements within the AMU and the squadron. In most cases, manpower for AMU overhead programs could be cut in half. In fact, personnel assigned to these positions would get some relief, some stability, from deploying.

While this consolidation gives maintenance units the much-needed capacity to implement PTM, meet overhead program manpower requirements, and simultaneously best support the entire spectrum of taskings, it competes with two operations community initiatives--the ITUD and the AMMP-97 Squadron Operations/Aircraft Maintenance Unit Facility Upgrade (HQ AMC/XP, 1996). First, this consolidation would align one AMU with two flying squadrons, each with 12 squadron-aligned aircraft. If each squadron used differing tail flash color schemes, the potential difficulties with this consolidation effort would be further magnified. While we rid ourselves of specialist "dispatch" union cards, we may have institutionalized other union cards. It is likely to be difficult for logistics communities to re-orient themselves to service "another flight's" aircraft. It is also likely

that expectations for a flying squadron to fly with its "own" aircraft on an ITUD will persevere.

Segregation of squadrons is exacerbated by the military construction projects scheduled to place flight line maintenance in newly constructed squadron operations facilities to support the mid-1991 objective wing guidance. At that time, maintenance was assigned to operations. "Keeping AMC and AFRES flight line maintenance personnel in a separate facility from the aircrew detracts from unit integrity and minimizes the effectiveness of the objective organization" (HQ AMC/XP, 1996).

Ideally, the maintenance personnel would be co-located with a consolidated specialist and a consolidated crew chief flight supporting 24 assigned aircraft. It would remove the artificial barriers of aircraft ownership and simplify centralization of overhead program management by assigning one program manager for each instead of two. This structure would more closely resemble the airlift maintenance structure currently being tested at McGuire AFB.

However, if you proceed with physically co-locating each maintenance flight with their aligned flying squadron, a merger of two flights would probably dictate two 12-aircraft teams, each with a specialist and crew chief flight who augment each other as necessary. The economies of scale would be realized with deployments of ten or more aircraft, off-setting aircraft unavailable due to scheduled inspections. In addition, training, fulfillment of overhead program manpower requests, and personnel absences could usually be covered with less manpower and no break in program management, while simultaneously meeting deployment requirements. However, AMU program

management and operations would be complicated by the artificial barriers, possibly not fully capitalizing on the consolidation effort.

As in any merger, there is the likelihood that there could be the loss of maintenance officer and superintendent management-level positions. No other losses should occur unless the KC-135 LCOM re-computation indicates otherwise. Of critical importance, however, is the capacity of the modeling and simulation technology to better capture pertinent data impacting maintenance operations to include the aforementioned (ITUD and 120-day personnel deployment) policies as well as the full spectrum of operations-- peacetime contingencies and the MRC worse case scenario. It may be that the integration of all of these factors generates a force structure comparable to or more expansive than today's PTM/MRC-sized force.

As in the within-flight merger option, the likelihood of the AMU ever having a full complement of aircraft is dubious if for no other reason than scheduled periodic inspections at home base or the depot. However, flights would less frequently have to "borrow" aircraft to fulfill tasking requirements.

Because this configuration of PTM would be a significant deviation from command maintenance management policy, it would need to be elevated to command functional managers for waiver approval. The consolidation of resources would require cross-functional coordination to assess manpower authorizations. More importantly, making the change palatable to both the operations and logistics communities would be critical to ensure successful implementation. It would take time to rid ourselves of a number of union cards established with the objective wing structure.

Recommendations to Improve Procedural Constraints

PTM Instructional Guidance. If PTM is restructured to one team within a flight or an AMU or to two teams within an AMU, the policy statement in AMCI 21-101 will need to be rewritten and the organizational chart revised. The makeup of the PTM team should be clearly stated in the Chapter 3 policy narrative to include: a) the composition of each flight or AMU team including *all* AFSCs (organized in specialist and crew chief elements); b) the number of assigned aircraft, 12 or 24, each team is responsible for; and c) the spirit and intent of PTM to maintain qualified flight line-based production teams (not create dispatch functions), capable of servicing, launching, and recovering aircraft at home base and deployed locations. Just as important would be clarifying the intent of the centralization of specialists, crew chiefs and all others, into two elements to capitalize on personnel resources to better support training initiatives, the ITUD, the 120-day personnel deployment policy, and the broad spectrum of peacetime and wartime taskings.

ITUD Operations Deployment Concept. If PTM is restructured to one team within a flight or an AMU or to two teams within an AMU, the ITUD operations concept can be implemented with no conflict to PTM. Neither of the team integrity concepts would be adversely impacted since the PTM teams would have been enlarged. If, however, no change to PTM occurs, PTM will likely be subordinated to the less stringent ITUD requirements. Flights, as structured today, can usually fulfill all the ITUD personnel requirements with their assigned personnel. On the other hand, PTM integrity cannot always be maintained because the UTCs are not structured to support PTM teams, but instead to minimize the number of personnel needed for any given tasking.

120-Day Personnel Deployment Policy. If PTM is restructured to one team within a flight or an AMU or to two teams within an AMU, the 120-day personnel deployment policy can be implemented with little to no conflict to PTM. The specialist manpower pools would have been enlarged and therefore, better capable to absorb the impact of frequent deployments within each AFSC. If however, no change to PTM occurs, PTM will likely be subordinated to the personnel policy requirements. Regardless of team "membership," the burden of deploying will be equally shared amongst all personnel. This is an Air Force level directive aimed at minimizing time away from home, improving troop morale, and revising declining retention rates of second-term airmen. Elevating this policy would be impractical unless the current data base demonstrates all other options have been exploited or subordinated. It would gain no favorable reception at any level of management.

Training Policy. If PTM is restructured to one team within a flight or an AMU or to two teams within an AMU, units will likely be able to meet or exceed the 75 percent trained (in-training)/experienced objective. By consolidating specialists, the pool of skilled craftsmen can be exploited to:

- conduct upgrade training for three- and five-level personnel on all shifts, at home base and at deployed locations.
- share training responsibilities amongst a larger pool of skilled, qualified, and certified technicians.
- ensure timely progression of on-the-job training.
- schedule personnel to more readily be released for formal classroom training requirements due to adequate specialist coverage for all shifts.

Under the proposed AMU structure, it would also be possible to reinstate the Lead Technician program. Assigning a full-time Lead Technician for each AFSC, exempt from mobility taskings, would instill much needed stability to the training program. The Lead Technician for each AFSC could be responsible for all of their specialists' training requirements. This would include identification of requirements, scheduling, assisting AMU trainers, conducting training, and initiating meaningful process improvement (quality assurance) assessments. In general, it would be "A to Z" program management, working hand-in-hand with AMU management and squadron training managers.

At best, the within-flight merger might permit the assignment of one full-time crew chief Lead Technician and one full-time specialist Lead Technician for all other five AFSCs to serve as Lead Technicians. If flight resources permit this opportunity, it would provide needed stability and training focal points in a fast-paced operations environment.

Conclusion

Several factors adversely impact full implementation of PTM, consequently affecting its viability within the KC-135 tanker maintenance community. While the maintenance community rigorously held on to the original MAC guiding principles for nearly a decade, many events transpired that were not compatible with PTM. Over time, the accumulation of these new policies, which were developed to cope with a very different post-Cold War national security environment, left the maintenance community wrongly postured for today's defense demands.

...the administration decided on what is called "the base force." This base force would be achieved by mid-decade and be 25 percent smaller than the Cold War force. Although America would retain

a forward presence in some areas, most of the force eventually would be based in the United States. Because regional contingencies were replacing general war as a concern, strategy, organization, training, and equipping were all altered accordingly. It was clear from the beginning that many in Congress wanted even faster and more far-reaching cuts. (Wendzel and Hartmann, 1994:322)

However, there are means, strategic and operational alternatives, to enhance PTM's viability as a tanker maintenance production concept.

Fully integrating PTM into AMC's strategic planning framework would prompt an annual review of the positioning strategy, ensuring it is appropriately linked to the command-identified goals, objectives, and operational tasks. The viability of PTM as a KC-135 maintenance production concept would be founded on the assertion that because of its application, rather than in spite of it, KC-135 units are better capable to operationally support the Air Force's core competencies (rapid global response and agile combat support) defined in our corporate, hierarchical strategic framework. Appropriate linkage implies PTM would be structured to organize, train, and equip maintenance personnel to achieve higher headquarters' strategic goals, objectives, and operational tasks. Pertinent competitive priorities, strengths and capabilities, necessary for PTM execution would be defined, functionally and structurally, in AMC maintenance management policy. Stated otherwise, the logistics flow, achieved through the PTM positioning strategy, would be structured to get the right things, in the right condition, at the right time, place, and cost to maintain a competitive advantage against our adversaries.

To accommodate the Air Force personnel policy (120-day personnel deployment standard) and the command operational and training initiatives (ITUD and 75 percent

training (in-training)/experienced objective), PTM needs to be restructured. This can be immediately accomplished within existing tanker flights by a simple merger of the two PTM teams. This option, although the least disruptive, is not the best solution. Labor economies of scale could not be realized enough to overcome, at best, a break-even distribution of each flight line specialty across all shifts.

The second option capitalizes on further consolidation of both specialists and aircraft. With the merger of two flights, PTM would not be in competition with higher headquarters' policies and procedures. Team integrity for PTM and the ITUD could be supported, albeit using a larger team. The PTM structure would mirror day-to-day business on the flight line. "Making" PTM work or "force-fitting" PTM into operations would be supplanted by a more flexible positioning strategy, posturing the maintenance community to achieve the spectrum of dissimilar peacetime engagement as well as wartime taskings. This alternative would create more disruption within both the maintenance and operations communities. New 1990's "union" cards would have to be discarded over time and with strong leadership. Maintenance personnel would routinely service a fleet of 24 aircraft, possibly with differing tail flash color schemes and two flying squadrons would share one AMU's maintenance resources. However, this merger probably pales in comparison to past organizational realignment efforts.

To facilitate this restructuring, instructional guidance should explicitly document structural and operational parameters. It must be remembered, however, that universal application of singular production concept across several diversified operations (air refueling and strategic and tactical airlift with at least six different weapon systems) is

probably not feasible. Weapon system-wide deviations, rather than base-unique waivers, could be documented in command guidance. This would officially recognize that solutions to problems on one weapon system may elicit different problems on another weapon system, creating a cascade of new and interdependent conflicts. Such a case may occur with the realignment of CONUS-based C-130 tactical airlift under AMC on 1 April 1997.

We continue to struggle with similar issues--our structure, our training, and our equipment. Is PTM still evolving and maturing as a maintenance production concept or is it simply stagnating and not reaching full implementation due to constraints with a long shelf-life?

We have become progressively smaller, more centralized, and closer to home at a time in our history when our nation commits its military to more frequent, nonroutine (peacetime) operations worldwide. Armed forces manpower trends speak for themselves. In fiscal year 1990, Air Force end-strength was 535,000 and is projected to be 381,000 in 1997 (Mehuran, 1996:41).

Units are "slicing," fragmenting, tailoring, and paring resources to accomplish back-to-back contingency taskings unaccounted for in the LCOM with the hopes of being able to "reconstitute" (Bush Administration key national security strategy concept) for global war-fighting capability. New concepts, strategies, and doctrines are needed to guide the Air Force to organize, train, and equip forces for crises and lesser conflicts as well as for MRCs.

The pattern is evident: After each world war, air power developed by responding to the challenge posed not so much by the *next* war as by the

nation's *nightmare* evoked by the last war. Today, the nation's nightmare does not seem to be an MRC, which may be the U.S. military's standard for a "proper" war that can be fought and won. Rather, the nation's nightmare seems to be about finding itself held hostage-- as it was in Vietnam, as the Soviets were in Afghanistan--in an endless, unwinnable conflict.

Now, after the Cold War, the challenge for air power could very well be to offer the nation's leadership military alternatives to crises and lesser conflicts that the nation wants neither to ignore nor to be held hostage by. Air power--with independent capabilities to feed, supply, rescue, police, and punish from the air--could be fashioned to address urgent problems with our being held hostage. (Builder and Karasik, 1995:xviii)

Considering the foreboding forecasts of even more limited military resources, military organizations can benefit greatly from "out-of-the-box" proposals. Challenging doctrinal tradition is essential to provide fundamentally realistic scenario frameworks for modeling and simulation tools used to forecast the shape and size of our future force structure. Unit level flexibility to package (slice) resources commensurate with the task at hand is more relevant today than ever before in our nation's history. Organizations with flexibility planned as an integral structural component will likely be better mentally prepared and better equipped to respond to a highly diverse spectrum of conflicts.

It appears we need to posture our maintenance community differently and root its structure in a strategy- and resource (dollar)-sensitive planning framework. Ridding the maintenance community of counter-productive "union" cards and promoting cross-utilization training initiatives positively contribute to a downsized force structure. What must be addressed, however, is the appropriate depth of decentralization without diminishing our strengths and capabilities--flexible and reliable rapid response at a lower cost--to maintain our "Global Reach, Global Power" competitive advantage.

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Vita

Major Terry F. Moore [REDACTED] She attended Keene High School, Keene, New Hampshire. She earned a Bachelor of Arts degree in Psychology (Summa Cum Laude) from Plymouth State College, University System of New Hampshire, in 1975. In 1982, she graduated with honors from the University of Southern Maine with a Master of Science in Adult Education.

A distinguished graduate of Officer Training School (1984) and an honor graduate of the Administration Officer Course (1984), she reported to her first assignment as Executive Officer, 3902nd Supply Squadron, Offutt AFB, Nebraska. In October 1985, she was selected for special duty assignment to the Air Force Academy as an Academic Affairs Staff Officer in the Directorate of Curriculum and Scheduling. During her tour, she completed Squadron Officer School. She assumed responsibility as Section Commander of the 1003rd Civil Engineering Squadron in April 1988. In 1989, Major Moore served as Executive Officer, Air Force Forces, during her six-month temporary duty assignment to Joint Task Force Bravo, Soto Cano AB, Honduras. She also attended the Special Operations School's Latin American Orientation Course.

Upon her return to Peterson AFB, she was selected as the 3rd Space Support Wing Executive Officer. Sixteen months later, she received a remote assignment to Osan Air Base, Republic of Korea. Her one-year tour included serving as Section Commander of the 51st Aircraft Generation Squadron and the 51st Maintenance Squadron.

In July 1992, Major Moore attended the Aircraft Maintenance and Munitions Officer Course at Chanute AFB, Illinois. At Grand Forks AFB, North Dakota, she was assigned as Flight Commander, Maintenance Flight, in December 1992, Assistant Maintenance Supervisor in April 1993, and Maintenance Supervisor in February 1994 for the 319th Maintenance Squadron, supporting the B-1B and KC-135R/T weapon systems. She served as the Senior Maintenance Officer in the 905th Air Refueling Squadron and shortly thereafter was reassigned as a Sortie Generation Flight Commander in the 319th Aircraft Generation Squadron.

In February 1996, she entered the School of Logistics and Acquisition Management, Air Force Institute of Technology, as a full-time student in the Advanced Study of Air Mobility Program. She completed Air Command and Staff College in June 1996. Major Moore will be assigned to the United States Transportation Command in Spring 1997.

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